

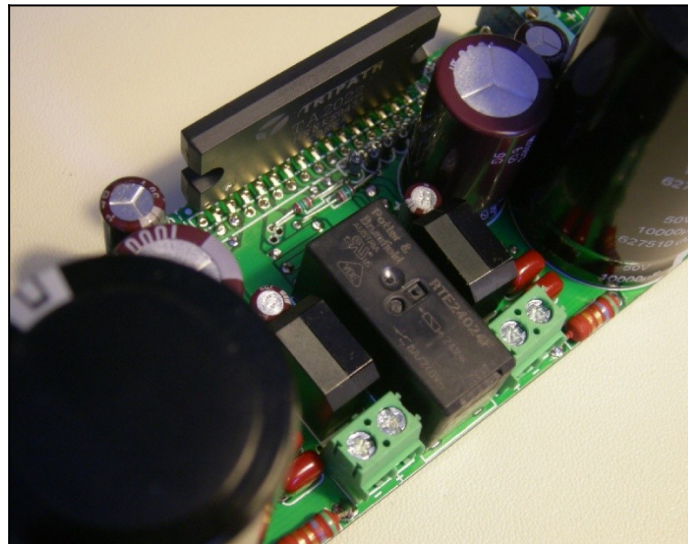
AMP10-BASIC

Assembly Instructions

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AMP10-BASIC FEATURES

- Stereo inputs/outputs
- Audiophile sound quality, < 0,015% THD+N at 2x50 W RMS, 8 ohm
- Footprint, 50x160 mm
- Line level analogue audio inputs. Sensitivity adjustable with external resistors
- High efficiency 85-90% mean small heat sink and small transformer requirements
- Power supply for main power and +5V on the board. Just add a transformer
- Speaker protection relay on the board
- Mute function for click-less on-off
- Over / under voltage turn off
- Over current protection, temperature overload protection
- The module is suitable for amplifiers and active speakers

TA2022 FEATURES

- Class-T architecture
- High Power
- 100W @ 4Ω, 1.0% THD+N
- 90W @ 4Ω, 0.1% THD+N
- 60W @ 8Ω, 0.1% THD+N
- "Audiophile" Sound Quality
- 0.015% THD+N @ 70W 4Ω
- 0.015% THD+N @ 45W 8Ω
- 0.10% IHF-IM @ 25W 4Ω
- High Efficiency
- 92% @ 88W 8Ω
- 87% @ 125W 4Ω
- Dynamic Range = 102 dB
- Mute Input
- Integrated Gate Drive Supply
- Over-current protection
- Over and under-voltage protection
- Single ended outputs
- Outputs can be operated in bridged mode
- 32-pin SSIP package

WARNING: The voltages and currents involved in building this amplifier can be lethal if not handled properly. If you do not have sufficient knowledge, do not proceed in building or using this kit. 41Hz Audio can in no way be held responsible for the consequences of the use of the kit.

The kit is not suitable if you have no experience in soldering and electronics.

On delivery, check that all components have been included. If something is missing, let us know immediately, so we can replace then and/or correct the packaging. Components packaged in an aluminized bag should be considered ESD sensitive and should be handled using normal ESD precautions.

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Introduction

Introduction

Thank you for choosing an audio kit from 41hz.com!

On delivery, check that all components have been included. We do double-check the component count but mistakes can happen. Please contact us at once if something is not OK with the shipping so we can correct the mistake.

Assembly of the kits requires the usual set of electronics working tools:

- Wire cutter and screw driver, tweezers or fine pointed pliers.
- Soldering iron. The boards are double sided, double weight copper so a high-power soldering iron is recommended, especially for components connected to the ground plane. Solder irons without temperature control should not be used.
- A magnifying glass/loupe of the type that you wear like a pair of glasses or like a cap is recommended, as it increases the precision and quality of your work
- Solder flux of no-clean type and soldering wick are useful extras.

IMPORTANT NOTE: 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.

Optional components

The following will at some stage be needed to complete the amplifier, but is not included in the kit:

- **Transformer.** A toroid with a nominal voltage of $\pm 18V_{AC}$ to $\pm 24V_{AC}$ is recommended. More The fuse should not be higher rated than the transformer maximal nominal load.
- Heat sink. Screws and heat conductive paste to mount the heat sink.
- It is recommended that you solder hookup wires to the board. Optionally you can fit Screw / solder terminals which are included.
- A mute/un-mute **switch** is *recommended* for thump-less power-on. You can wire this to a switch on your front panel. Optionally use a 2.5 mm jumper (50 mil) on the board.
- You can optionally fit a volume control

Soldering

The kit is not suitable for complete beginners. If you are not familiar with soldering, it is recommended that you get help from someone who knows how to do, and that you do some test soldering on a separate scrap piece of material.

The boards for AMP10-BASIC are double weight, double sided copper. Even if the PCB and components are small, quite a powerful soldering iron is very helpful. Especially components and pads connected to the ground plane require significant heating. A temperature controlled 50W soldering iron is the minimum recommended. At the same time, applying excessive heat may damage the FRP plastic of the board, causing the copper pads to come off. Preheating the board to around 100°C will make work easier and allows using a lower solder iron temperature which decreases the damage risk. Increasing the solder iron temperature is NOT recommended as it increases the risk of damaging the board. Some information on how to solder components is available in the forum on <http://www.41hz.com>

Power supply

The AMP10-BASIC requires a dual rail power supply plus a stabilized +5V 100 mA supply. The rail voltages could be **+/-20V to +/-30V**. Higher voltage gives a higher possible maximum power output. With 4 ohm, +/- 30V is the maximum recommended by Tripath, to avoid tripping the over-current shutdown at high power. With 8 ohm loads, +/- 35V can be used without tripping the over-current limit. Toroid transformers are available with standard values. Nominal voltages of +/-18V_{AC} to +/-22V_{AC} are common. When rectified, this will give about +/-24V_{DC} to +/-30V_{DC}. Note that transformer voltages are given for full rated power. At low power, the voltage will be slightly higher. For maximum power a 2x22V_{AC} transformer would be about ideal.

Mains power is lethal! If you are not professionally qualified to work with mains power, get help from someone who is!

On the board there is a regulated supply for the +5V. It uses a LM317 voltage regulator and taps from the positive main supply. The +5V should not draw more than about 60 mA. A jumper, J10, can break the +5V supply which can be useful when testing. The +5V is used for the analogue input amplifier and the in-chip digital parts of the TA2022.

Considerations before you start

Selecting the gain

The amplification, or gain, of the amplifier is set in two stages: Input stage gain and power stage gain. Optimally you should match the input gain to your signal source signal level and the power stage gain to your supply rail voltage.

Input stage gain

In *table 1* you can see some typical input signal sources and gains you can set with the supplied components. The maximum recommended voltage *out* of the input stage is +/-2V peak to peak (1.41 VRMS), including some margin. At higher output signals, the input stage may clip. The amplifier input stage in the Tripath chip is of the inverted operational amplifier type. The gain is calculated as: $\text{Gain} = -1 * R_{\text{feedback}}/R_{\text{in}}$ On the board, R3 and R4 are the R_{in} and R43 and R44 are the R_{feedback} . With the kit, there are four 22 K Ω resistors and two 47 K Ω . With these resistor values, you can choose one of three different input gains/sensitivities as shown in table 1. If you use other input resistor values, they should be of a low noise type. I recommend metal film resistors.

| R_{in} | R_{feedback} | Gain [V/V] | Suitable signal source |
|-----------------|-----------------------|------------|---|
| 22 K Ω | 47 K Ω | -2.1 | Direct connection of portable MP3/CD player with built in volume control or via a passive volume pot. |
| 22 K Ω | 22 K Ω | -1 | General use |
| 47 K Ω | 22 K Ω | -0.47 | (Pro) preamplifier with fairly high output signal |

Table 1. Input stage gain setting recommendations

Modulator gain

The “modulator gain” is the power stage voltage gain. You can select this to match your power supply voltage. The modulator feedback resistors are R31, R37, R41 and R52. The supplied value for these is 8.2Kohm. These are suitable for rail voltages 25-30V. There are also 10K supplied, suitable for rail voltages 27-33V. If you use other resistor values than the supplied, you should use 1% tolerance resistors, preferably of the metal film type. For details on selecting modulator feedback values, see the TA2022 chip datasheet from Tripath, available on the 41hz Audio support web site.

Summary on selecting the gain

- Select **input gain** to match the music source signal level
- Select the **modulator gain** to match the supply rail voltage

- **The total gain is the input stage gain multiplied by the modulator gain.**

Just remember that music signals are very dynamic by nature, signal levels are approximate and impossible to predict accurately.

AMP10-BASIC Mounting the Components

While you can mount the components in any order, here is a recommended sequence.

Work slowly and carefully. Fixing mistakes can be very frustrating and time consuming.

1. Start by building the 5V section. The components are Q5, C51, C150, R100, R80, R81. J10 connects 5V to the rest of the board. R100 connects the V5 section to the positive power rail. Leave J10 open until you have tested the 5V section and verified that the output voltage is near 5V. If V5 is higher than 5.5V, the Tripath chip can be damaged. You can test the 5V by connecting the positive rail to any positive source of 10V to 30V.
2. Solder all components on the bottom side of the PCB, except C455 and C45 which will be mounted later with the Tripath chip. Note that the diodes have a direction!
3. Continue with the smallest components on the top side, i.e. resistors first (read the **Considerations** section before doing this). Note that all electrolytic capacitors (round cans) have a polarity. Generally, the minus is marked on the capacitor, while the positive lead is usually longer than the negative. The positive pole is indicated on the PCB is quadratic when possible, while the negative is usually round. Work yourself up to larger components. I suggest you save the large capacitors until last.
4. Mount the Tripath chip, together with C455 and C45. These are 100V rated capacitors that are indicated by circles and lines on the bottom side of the board. These two capacitors have 5 mm lead spacing and should be mounted in the same holes as the Tripath chip, pin number 4 and 8, 9 to 12 respectively. These capacitors are critical and need to be mounted as close as possible to the chip, after cutting their leads short. Make sure the Tripath chip is horizontally and vertically aligned to the PCB.
5. Mount the large capacitors, cables / connectors and any other component you have forgotten earlier.

Power up and test

Do not connect or solder *anything* while the power is connected

When you have verified that the 5V is OK, you can close J10 by soldering a short wire in place.

Use a low fuse value or current limited power supply for testing. The amp needs no more than 200mA per rail for testing.

1. Connect the power to the two power connectors (but not speakers and signal source yet). Turn on the power. If fuses are OK, measure the voltage on each big bulk capacitor to see that it is OK. The relay should have clicked when power was supplied. The amp should now draw around 100mA on each rail
2. You can mute and open the speaker relay by closing J2. If you want, you can wire this to a mute switch on the front panel of your amp box. When J2 is closed, the relay should click and the current go down a bit.
3. If all seems OK, then measure the voltage on the output (after removing J2). By turning the trimmers R54 and R55 you can zero the output voltage. It should be possible to have less than 10 mV on the speaker outputs.

4. If all is OK, connect speakers and signal input, turn on the power and enjoy the music!

Hookup and shielding.

Switched mode amplifiers are a bit noisy by nature, in the sense that they emit EMI that is generated by the high power, high frequency output transistors. This can be transmitted via cabling or as radiated in the atmosphere and picked up by other equipment like radios, preamplifiers etc or by the amplifier inputs. It is therefore recommended that some precautions are taken. The most important is that the amp is housed in a metal/shielded casing.

Proper grounding is also important. Note that input ground should be taken to the board J1 connector ground, not to the housing or power supply ground. The speaker returns should lead to J8/J9 ground, not to the casing or power supply ground. It is strongly recommended that hookup cable for the signal input is shielded and as short as possible so that it does not pick up noise from the outputs. Input cables should lead away from the outputs as far as possible.

Speaker cable and power cables should be twisted to limit EMI radiation. All cables should lead the shortest way out of the casing. For most users, using shielded cables and a metal housing provides sufficient EMI damping. Note; while the speaker returns are “ground” you should connect them to the speaker connectors on the PCB, and not to the amp housing. The same is true for signal inputs; lead the grounds of the inputs to the input connector on the PCB rather than to the amp housing.

The TA2022 copper slug on the back of the chip is connected internally to the chip ground. Therefore, it is not required to have electrically insulating mounting of the chip to the heat sink. However, it may be better to use insulation for two reasons; one is to avoid ground loops and the other is to reduce EMI from the heat sink. Some experimentation is recommended and feedback on this would be appreciated.

Important The 5V regulator has a back metal side that is NOT connected to ground, but to +5V. If you mount this chip to a heat sink, then the heat sink must be isolated.

List of related documents

These documents can be downloaded from the support site at www.support.41hz.com

- BOM (Bill of Materials) for this model
- Schematics for this models
- High resolution pictures
- Generic troubleshooting guide
- Tripath TA2022 chip data sheet