TA3020 Audio Amplifier kit v3k

The TA3020 Audio Amplifier kit module is a Class T Stereo Audio Amplifier based on TA3020 digital audio power amplifier driver made by formerly Tripath® Company. The design of this board is in accordance with the manufacturer datasheet and recommendations, as well as the reference designs. Furthermore, some improvements has been made to make the board more compact and suitable to use both in new designs, in which the user will adopt the preferred housing, input stages and power supply, and can be used also as a drop-in replacement for existing audio amplifiers, which already have housing, transformer, and input stage.

Amplifier Features:

- Output Power: 2x250W at 4Ω, or 130W at 8Ω, with max. 0.1% THD+N, at +/- 54V Supply Voltage.
- Output Power: 2x360W at 4Ω, or 190W at 8Ω, with max. 0.1% THD+N, at +/- 60V Supply Voltage.
- Output Power in Bridge mode: 960W at 4Ω or 540W at 8Ω.
- Audiophile sound Quality: 0.02% THD+N at 100W at 4Ω or 50W at 8Ω.
- Very good efficiency: Up to 95% at 2x180W at 8Ω or up to 90% at 2x350W at 4Ω.
- Output over-current and short-circuit protected, power supply over-voltage and under-voltage protection.
- Mute control and Mute status pins for controlling the amplifier status within the system.
- Two output MOS-FET choices, STW34NB20 default or IRFP4321/IRFP4228 for optimized design.
- Compact size, 100x100x30mm, no heatsink version, board only, or 135x100x30mm with transistors mounted horizontally, or 120x100x57mm the heatsink version, with both 50mm tall heatsinks installed.
- Double layer, 1.6mm thick PCB with thick copper traces, for lowest stray inductances, microstrip current sense resistors made on PCB for best noise immunity, lowest EMI, and lowest parasitic inductance.
- Only THD components used, without any SMD, allowing quick and easy assembly.

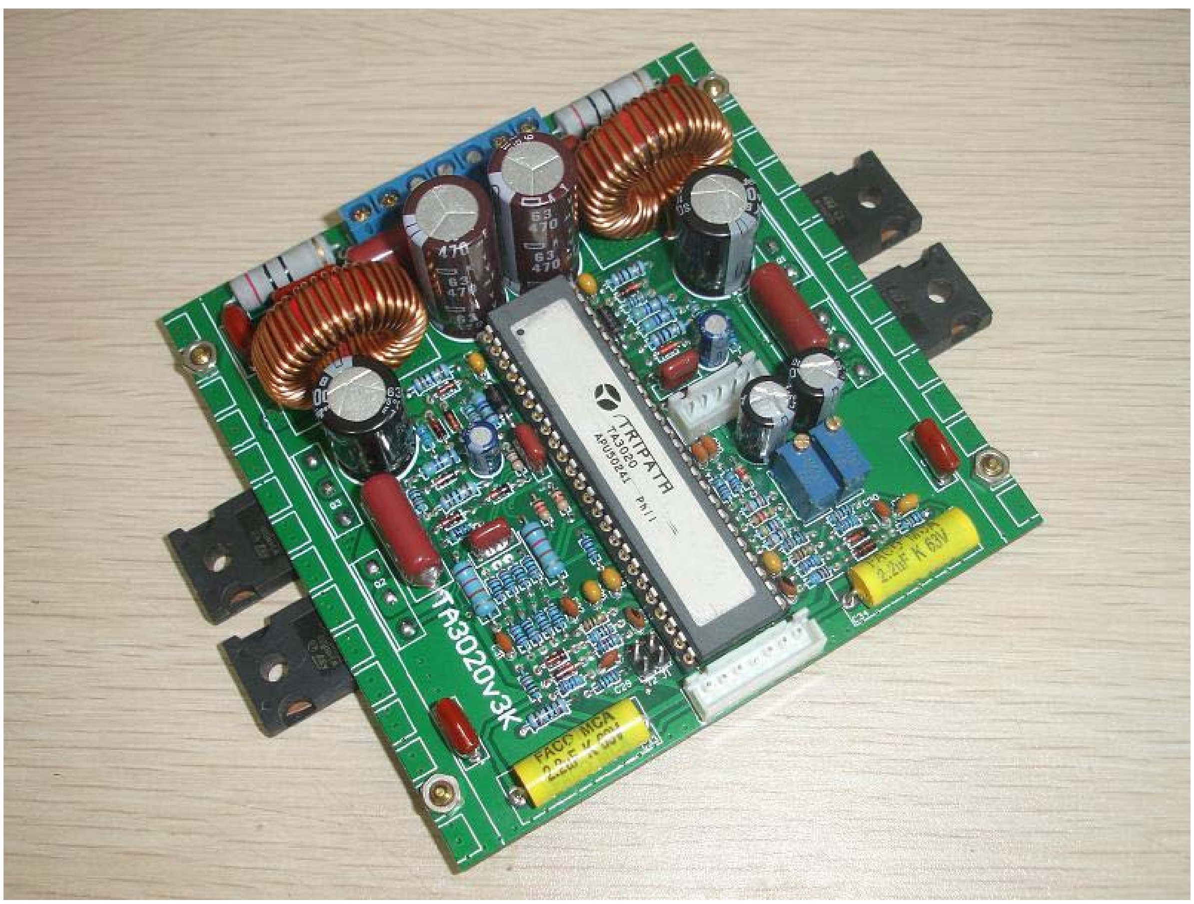

Figure 1: TA3020 Audio Amplifier Module v3b

Amplifier Description:

TA3020 Class T Stereo Audio Amplifier is built around TA3020, dedicated digital audio power amplifier driver. The main blocks of this amplifier are: Input stage, driver, which uses TA3020 IC, power stage, which uses 4 STW34NB20 or IRFP4321/IRFP4228 MOS-FET's. The amplifier schematic is according with the reference design provided by Tripath. In addition to this, some improvements were made, especially on the layout of the PCB.

The audio input signal is provided to the TA3020 IC from signal connector, pin 5 for the Left channel and pin 7 for the Right channel through a second order low pass filter with the cut-off frequency set to 24KHz. The filter has better than 3dB linearity from 16Hz to 21Khz and better than 1dB from 46Hz to 19Khz. The purpose of this filter is to attenuate the ultrasonic unwanted components which might affect the stability of the amplifier and in some cases can affect the reliability if large amplitude high frequency signals are supplied, which will result in peaking in the output Zobel network, with possible damage. As can be seen from the schematic, the input pins are surrounded by GND pins for better S/N ratio. The input capacitors, C33 and C34 are high quality film type, with the value in the range of 1uF to 4.7uF. The current boards are equipped with 2.2uF non-polar metal film capacitor, which has proved to offer a clean and transparent sound with good linearity in all audio bandwidth. Next, the resistors R44 and R50 are part of the input stage, and set the amplifier input impedance. The TA3020 input stage is configured as an inverting amplifier, allowing the system designer flexibility in setting the input stage gain and frequency response. The TA3020 amplifier gain is the product of the input stage gain and the modulator gain: AVTA3020 = AVINPUTSTAGE * AVMODULATOR. For this amplifier, is recommended to not change the value of this resistors or the input gain, otherwise the input low-pass filter characteristics will be altered. The gain value is set to 25V/V which is 28dB. Note that wider gain values are not recommended due to the stability issues which can occurred for higher gain or lower gain values. If higher gain is required, a preamplifier should be used prior the TA3020v3k amplifier stage, which will provide the required input signal amplitude. The input stage of the amplifier is biased at approximately 2.5V DC using VR1 and VR2 variable resistors. This value is adjusted so that the output DC offset to be as close to 0V as possible (less than 40mV) otherwise the pumping effect will lead to increased voltage on one of the supply rails and the amplifier will shut-down under Over-Voltage condition. The DC Offset during Mute and without any load will be ~2.5 volts, but will decrease to 0V after connecting the load. Note that the DC offset was set for the assembled boards and during test, and does not require further adjustments. For good S/N ratio, is recommended to use shielded signal cables for signal input, and this cables must be as short as possible, and avoid the crossing in close proximity to the power stage or output cables, which can create unwanted feedback. Pay attention to the GND loop which can decrease S/N performances lead to instability and increased output noise.

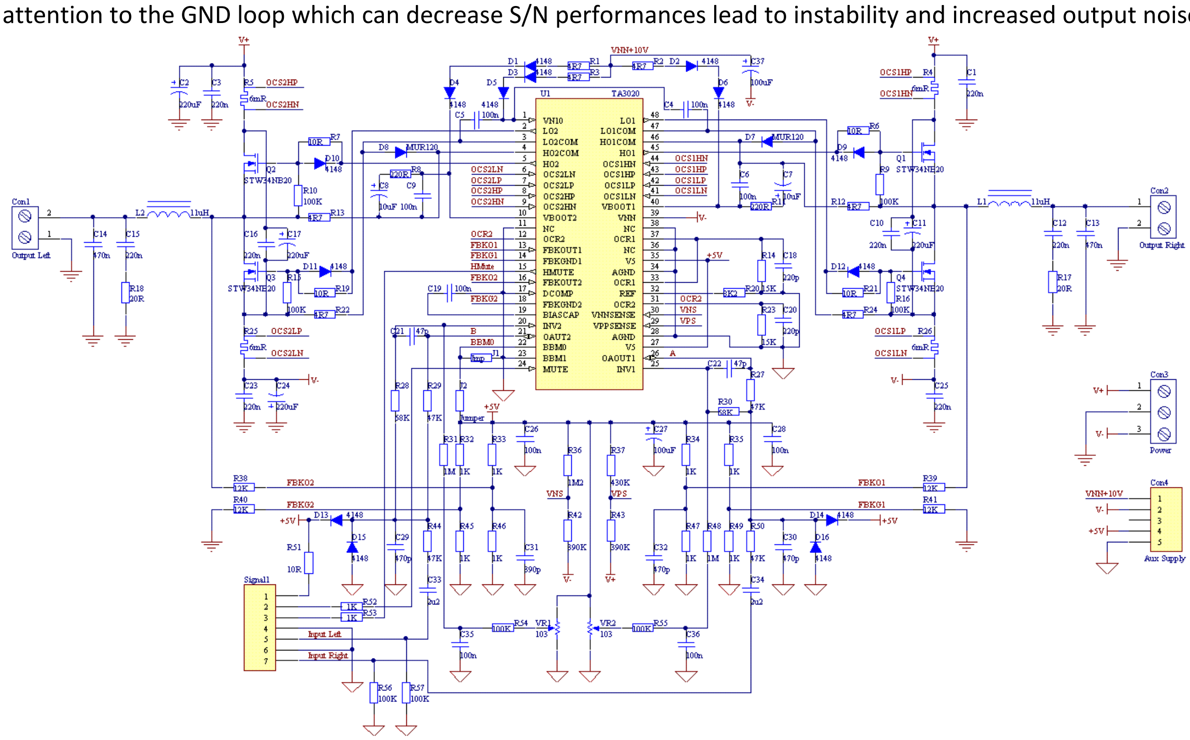

Figure 2: TA3020 v3a Audio Amplifier Module Schematic Diagram

The TA3020 Audio Amplifier Module control section consists of Mute circuit, under-voltage, lockout, over-voltage lockout, Over-current and short-circuit protection circuits, as can be seen in Figure 2. When a logic high signal is supplied to Mute, on pin 2 of the Signal connector, or the pin is left floating, both amplifier channels are muted (both high and low-side transistors are turned off). By default, the amplifier is configured to start in Mute mode, and to enable the amplifier, the Mute pin (pin2 of Signal connector) must be connected to GND (pin 4 or pin 6 of Signal connector) Thus, if a logic level low is supplied to MUTE, and both amplifiers are fully operational. There is a delay of approximately 200 milliseconds between the de-assertion of MUTE and the un-muting of the TA3020 Audio Amplifier Module. The HMute output (pin3 of Signal connector) is a 5V logic output that indicates various fault conditions within the device. These conditions include: over-current, overvoltage and under-voltage. The HMute output is capable of directly driving an LED through an on-board series 1kΩ resistor. Pin1 of Signal connector can provide 5V at max. 50mA current, for Mute or a remote circuitry turn ON when the amplifier is powered ON. Note that the voltage is supplied from 5V bus through a 10R series resistor, and short-circuiting this voltage should be avoided, otherwise the resistor might be damaged. If is not used, should be left unconnected.

The TA3020 Audio Amplifier Module has built-in over-current protection circuitry to protect itself and the output transistors from short-circuit conditions. The TA3020 uses the voltage across a resistor R_S (measured via OCS1HP, OCS1HN, OCS1LP and OCS1LN) that is in series with each output MOSFET to detect an over-current condition. R_S and R_{OCR} are used to set the over-current threshold. The OCS pins are Kelvin connected for proper operation. When the voltage across R_{OCR} becomes greater than V_{TOC} (approximately 1.0V) the TA3020 will shut off the output stages of its amplifiers. The occurrence of an over-current condition is latched in the TA3020 and can be cleared by toggling the Mute input or cycling power. The Rs = 6mΩ (R5, R25 for Left Channel and R4, R26 for Right channel) and R_{OCR} = 15KΩ. For this amplifier module, an innovative design was made, the Rs resistors were replaced with microstrip PCB traces instead of classic, bulky power resistors. The main advantage of this resistors type is that they provide a much lower parasitic inductance, very important when high frequency large currents are crossing them, almost perfect symmetry for each power stage, no thermoelectric induced noise due to Seeback effect which is present at classic power resistors where two different alloys are connected together, and much better repeatability, all the PCB's from one lot will have better than 1% precision values. The thermal drift which might occur when with rising temperature, increasing the ohmic value of the resistors, is useful, reducing the over-current trip point of the amplifier at high temperature operation. With this resistors values, the over-current threshold is set at 27.84 A, which is about the double of the maximum current supplied to a 4R load at maximum power, and within the maximum current capability of the output MOS-FET's.

The TA3020 has built-in over and under voltage protection for both the V+ and V- supply rails. The nominal operating voltage will typically be chosen as the supply "center point." This allows the supply voltage to fluctuate, both above and below, the nominal supply voltage. VPPSENSE (pin 29) performs the over and under-voltage sensing for the positive supply, V+. VNNSENSE (pin 30) performs the same function for the negative rail, V-. When the current through $R_{VPPSENSE}$ or $R_{VNNSENSE}$ goes below or above the normal values, (caused by changing the power supply voltage value), the TA3020 will be muted. VPPSENSE is internally biased at 2.5V and VNNSENSE is biased at 1.25V. Once the supply comes back into the supply voltage operating range (as defined by the supply sense resistors), the TA3020 will automatically be un-muted and will begin to amplify. There is a hysteresis range on both the VPPSENSE and VNNSENSE pins. If the amplifier is powered up in the hysteresis band the TA3020 will be muted. Thus, the usable supply range is the difference between the over-voltage turn-off and under-voltage turn-off for both the V+ and V- supplies. It should be noted that there is a timer of approximately 200mS with respect to the over and under voltage sensing circuit. Thus, the supply voltage must be outside of the user defined supply range for greater than 200mS for the TA3020 to be muted.

For the under-voltage and overvoltage lockout, the TA3020 senses the voltage of the power rails through external resistor networks connected to VNNSENSE and VPPSENSE. The over-voltage and under-voltage limits are determined by the values of the resistors in the networks, and are set approximately within the range of +/- 36V DC to +/- 64V DC. If the supply voltage falls outside the upper and lower limits determined by the resistor networks, the TA3020 shuts off the output stages of the amplifiers. The removal of the over-voltage or under-voltage condition returns the TA3020 to normal operation. Please note that trip points are IC dependent and might vary from one IC to another with as much as 3-4V, and also temperature dependent. If other trip points are needed, the values of resistors R36, R37, R42, and R43 should be changed accordingly. For details, please read the TA3020 datasheet. In any case, never set the over-voltage trip point above +/-66V or permanent damage to the amplifier will occur in case of exceeding the maximum supply voltage. Also, the minimum trip point should not be set below +/-32V, and the amplifier should not be supplied with less than +/-36V otherwise the stability might be affected.

The TA3020 Audio Amplifier Module driver is integrated in the TA3020 IC, this simplifying the amplifier design. The main role of the driver stage is to provide V_{GS} voltage for the output MOS-FET transistors. The driver stage is powered from the 10V DC with respect to V_{NN} auxiliary supply. The low-side MOS-FET's are driven using the voltage provided, and high-side MOS-FET's are driven using bootstrap supply, which consist of D4, D6, C9, C6, C8, C7, R8, and R11. The TA3020 IC contains also the voltage level shifter, for driving the output MOS-FET's which have floating Gate and Source voltages with respect to GND. The driver's pins from the TA3020 IC are connected to the output MOS-FET's through resistors and diodes, (R7, R19, R6, R21, D10, D11, D9, and D12) which are used to control MOSFET switching rise/fall times and thereby minimize voltage overshoots. In addition to these resistors, Source resistors were also added, to protect the TA3020 IC from overshoots, reduce noise and increase reliability. They also dissipate a portion of the power resulting from moving the gate charge each time the MOSFET is switched. If R_G is too small, excessive heat can be generated in the driver. Large gate resistors lead to slower MOSFET switching, which requires a larger break-before-make (BBM) delay. The optimum value of 4.7 Ω was chosen. The diodes which are connected in parallel with the gate resistors have the role of fast discharging of the gate charge during switch-off, and they must have very fast switching timing. 1N4148 type was chosen, which has very fast switching characteristics, and the maximum peak current is within the diode limits.

Another improvement was done on the drive section, by adding 2 extra diodes on the supply path for lower MOS-FET's supply, the D3 and D5, in series with R3 resistor. 1N4148 diodes were used as bootstrap diodes, two in series for each channel, to withstand the maximum reverse voltage. This diodes are among the fastest diodes available, and more important, have the lowest reverse recovery charge which is very important for a bootstrap diode. Even so, the resistors R1, R2, and R3 were connected in series with each group of diodes to ensure a soft transition when the diodes are switching, improving the overall EMI and signal to noise ratio. These diodes will reduce the voltage supplied to the lower drive with the same amount as the voltage for the upper drives is reduced by the voltage drop on the D1, D4, and D2, D6 diodes. Thus the supply voltage for the driver section should be higher, within 10.5 to 12V to make sure that at least 8-9V will be supplied to the MOS-FET's gates all the time. A higher voltage value is not recommended, because will lead to higher power dissipation in the TA3020 IC and possible damage.

The amplifier power stage comprises of 4 Power MOS-FET transistors, which provide the switching function required of a Class-T audio amplifier. They are driven directly by the TA3020 through the gate resistors. The devices used on this amplifier are STW34NB20 for the basic version or IRFP4321/4228 for the improved version. The key parameters to consider when selecting which MOSFET to use with the TA3020 are drain-source breakdown voltage (BVdss), gate charge (Qg), and on- resistance ($R_{DS(ON)}$). The BVdss rating of the MOSFET needs to be selected to accommodate the voltage swing between V_{SPOS} and V_{SNEG} as well as any voltage peaks caused by voltage ringing due to switching transients. Due to the good circuit board layout, the BVdss is only 20% higher than the VPP and VNN voltage swing, reasonable value. Ideally a low Qg (total gate charge) and low $R_{DS(ON)}$ are desired for the best amplifier performance. Unfortunately, these are conflicting requirements since $R_{DS(ON)}$ is inversely proportional to Qg for a typical MOSFET. The design trade-off is one of cost versus performance. A lower $R_{DS(ON)}$ means lower $I_2R_{DS(ON)}$ losses but the associated higher Qg translates into higher switching losses (losses = Qg x 10 x 1.2MHz). A lower $R_{DS(ON)}$ also means a larger silicon die and higher cost. A higher $R_{DS(ON)}$ means lower cost and lower switching losses but higher I_2R_{DSON} losses.

The output power MOS-FET's require a dead-time between when one transistor is turned off and the other is turned on (break-before-make setting) in order to minimize shoot through currents. BBM0 and BBM1 are logic inputs (connected to logic high or pulled down to logic low) that control the break-before-make timing of the output transistors. If the board is equipped with STW34NB MOS-FET's, 80nS dead-time is recommended, and for IRFP4321/4228 either 80 or 120nS can be used. Note that for 80nS on STW34NB20 boards, the idle current consumption is higher due to increased shoot-through of the MOS-FET transistors. Lower values than 80nS are not possible because the BBM1 was tied to GND, since the BBM1 setting would provide no-dead time at all or a very low dead-time of just 40ns, which is not used practically, this pin is connected to GND allowing just the BBM0 to change the values of dead-time, of 80 or 120ns. Because they can lead to lower efficiency, overheating, and eventually failure of the power stage, and there is no increasing in the audio performance more than the case of 80nS setting. For this reason, the BBM1 connection was left connected to GND permanently. To set the dead-time, **only one** jumper must be placed, J1 for 120ns or J2 for 80nS.

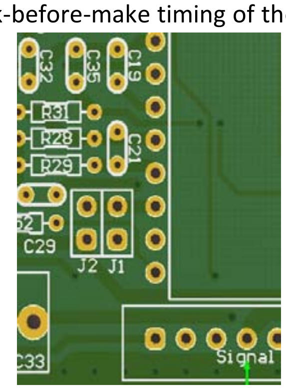

Figure 3: Amplifier BBM Setting

To reduce the voltage ringing in the power stage, few bypass capacitors are placed close to output power MOS-FET's. There are 2 types of capacitors: one type film type polypropylene capacitors, C3, C24, C1, and C25, placed very close to the output MOS-FET's before the over-current sense resistors, then the high ripple type, C16 and C10 capacitors placed across the supply tracks going into the MOS-FET transistors, very close to them, and the other type are electrolytic capacitors, for energy storage during peaks, C2, C24 and C17 with C11. The film capacitors are connected between V+ and GND, V- and GND and V+ to V-. They provide extremely low stray inductance and ESR, which is helpful for reducing ringing. The electrolytic capacitors acts as energy storage tank during peak power consumption, as well as minimizing the pumping effect which switching amplifiers experience at high power outputs and low frequencies. If the pumping effect is too high, this will lead to amplifier oscillations between ON/OFF states, since the under-voltage and over-voltage protection is not latched shutdown. By using high-capacity electrolytic capacitors, this phenomenon can be reduced. In the unlikely event that this phenomenon still occur, or when the output power demand is high, as in the BTL mode configuration, should increase the value of the electrolytic capacitors from the external power supply unit which is connected to this board.

After switching stage, the amplified PWM Audio Signal needs to be filtered to extract the audio component. For this purpose an LC low pass filter is used, with the cut-off frequency at higher value than is used in the classic Class D amplifiers. This greatly reduces the speaker interactions that can occur with the use of lower-frequency filters common in Class-D designs. Also, the higher-frequency operation means that the filter can be of a lower order, simpler and cheaper. The values chosen for the output filter are: Inductance of the filter coil = 11uH, made on Micrometals -2 core material, by wounding 30 turns of 1.2 mm (16AWG) copper wire. Capacitor has the value of 220nF, for 8R or more, load impedance and 470nF for 4-8R load impedance. The working voltage of of the capacitors is chosen to be 400V or 630V, and pulse type, high ripple type was chose, for increased reliability. In addition to these components, the filter contains a Zobel Network also, which is required in case that the amplifier is powered without load, to decrease the Q factor of the filter circuit above 50 KHz. Note that the Zobel resistor is not sized to dissipate the full power in case of uncontrolled oscillations or if the amplifier is used for high-power, high-frequency reproduction only. In this case, the resistor must be replaced with the same value, higher power resistor, able to dissipate all the reactive energy.

For operation, the amplifier requires an external power supply, either linear or SMPS which can all 4 supply voltages needed for proper operation. These are:

- A main differential supply voltage in range of +-36V to +-60V able to supply a current of at least 5A on each rail, recommended 10-12A for maximum output power.
- One 5V regulated and very well filtered, with GND separated from the main differential GND, and connected together only on the board. The current requirement is around 100-150mA.
- One 10.5 to 12V regulated and well filtered, with GND separated from the main differential and signal GND, but connected to Vnn supply. This voltage is required for the driver stage, and the current supplied should be at least 250mA, preferable 400mA for best performance.

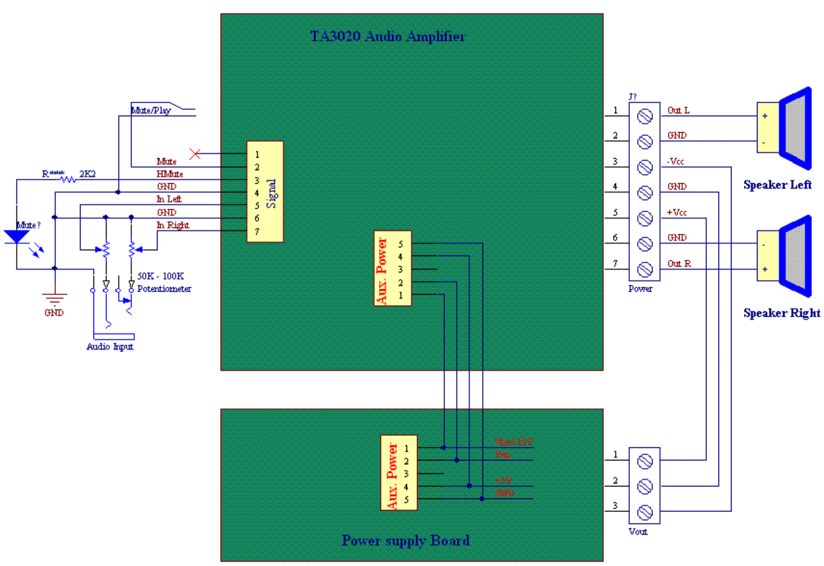

Figure 4: TA3020 Audio Amplifier Module supply connection diagram

The main differential voltage should be supplied on the connector 3, which is in the top middle of the board, between the output connectors. See the Figure 5 for connectors positions reference.

Note that the current amplifier PCB does not contain any auxiliary supply voltage regulators as the previous TA3020 amplifier versions, leaving the user to choose the best suitable auxiliary supply for its application. The main differential voltage should be fuse protected if is supplied from an external linear power supply; the values of the fuses should be 10A at 250V fast acting type.

The TA3020v3k amplifier kit can be used in many possible configurations, the simplest one can be seen in Figure 4. The input signal is supplied via signal connector through a 50K to 100K potentiometer, one LED is used for Status, and the Mute pin has a switch connected to activate or mute the amplifier. The power is supplied to the amplifier from the power supply, on screw type connector Con3, separately for the power stage and the small signal and driver stage, through the small 5 pins connector named Aux Power. For best performances, speaker protection module and PSS module should be used together with the amplifier kit and power supply.

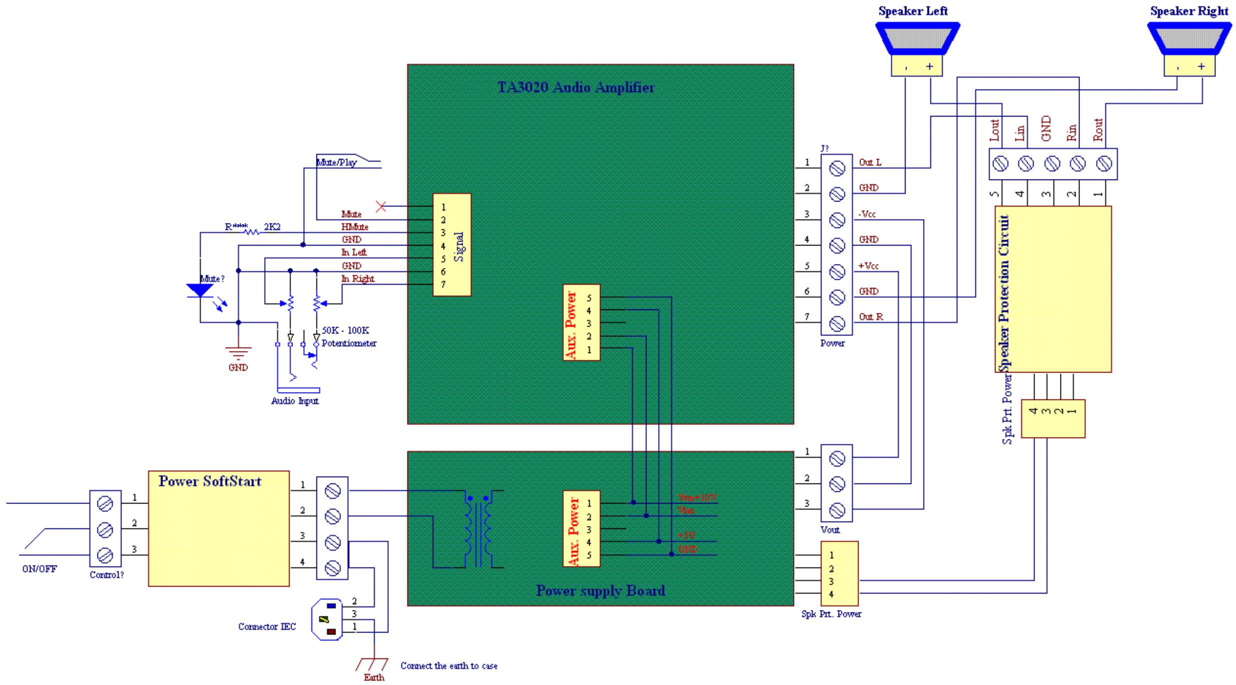

Figure 5: TA3020 Audio Amplifier Module supply connection diagram with Speaker Protection and PSS modules

Besides the current possible configurations, another two modules which are under development stage at the moment when this document was written (22 Sept. 2011) will be available soon. These two modules are: One complete linear power supply with all the protections, relays, rectifiers, regulators and capacitors included on one board, for which the user only needs to add a mains transformer, and one switched mode versions for which even the mains transformer is not required. Please check back soon, before the end of the year. This document will be updated at the moment when these boards will be available.

The PCB Layout design has an important contribution to the overall performance of the TA3020 Audio Amplifier Module. That's why double layer, FR-4 material with 1.6mm thickness and copper tracks thickness of 70um or 2 oz was chosen. The tracks width, were calculated to withstand the currents which they have to carry, and also the distance between adjacent tracks which carries higher voltages than 50V is big enough to satisfy the clearance conditions imposed by the design standards. The size of the PCB is 100 x 100 mm or 4 x 4 inch, and has 5 mounting holes, 4 holes are on the corner of the PCB and one at the top-middle side of the PCB. The mounting holes are 3.2mm diameter or 0.12 inch, copper plated and reinforced with 8 vias around the main hole, for better mechanical strength. Besides these aspects, perhaps the most important aspect of the PCB characteristics is that the thickness of the copper layer has a direct influence on the amplifier over-current tripping point because of the on-board resistors. The main components layout and the Input and Output connectors pin out can be seen in the Figure 6. The layout is almost symmetrical for Left and Right channel with respect to center axis, for better performances and aesthetical reasons.

The TA3020 Audio Amplifier Module can be used in bridge mode, with the output power increased considerably. For this, an 180°shifted audio signal with equal amplitude must be provided. The load will be connected between the Left Output and Right Output, without connection to GND. The maximum output power will be about 1280W at 4Ω or 700W at 8Ω. Note that at low impedance, the Amplifier can experience over-current protection shut-down, due to the increased current. It is recommended to not use the amplifier at load impedances lower than 4Ω.

The layout and size for the printed circuit board and mounting holes can be seen in Figure 6. The board can be installed in the amplifier case in horizontal position, or vertical position, which is more convenient. The pinout for input and output connectors can be seen. It is recommended to use heavy gauge wires for Power Supply and Loudspeaker Output and short shielded cables for Audio Input. The Aux. supply cable should be routed far from the output inductors to the power supply board and the correct connections must be respected. Note once again that the negative polarity for Driver stage is referenced to Vnn, not GND. Incorrect connection will result in smoke and frustrations.

If two or more amplifiers are used in the same case, they should be installed at a suitable distance, to allow cooling and avoid EMI interferences. In any case, the signal input wires, should not be routed near the output section.

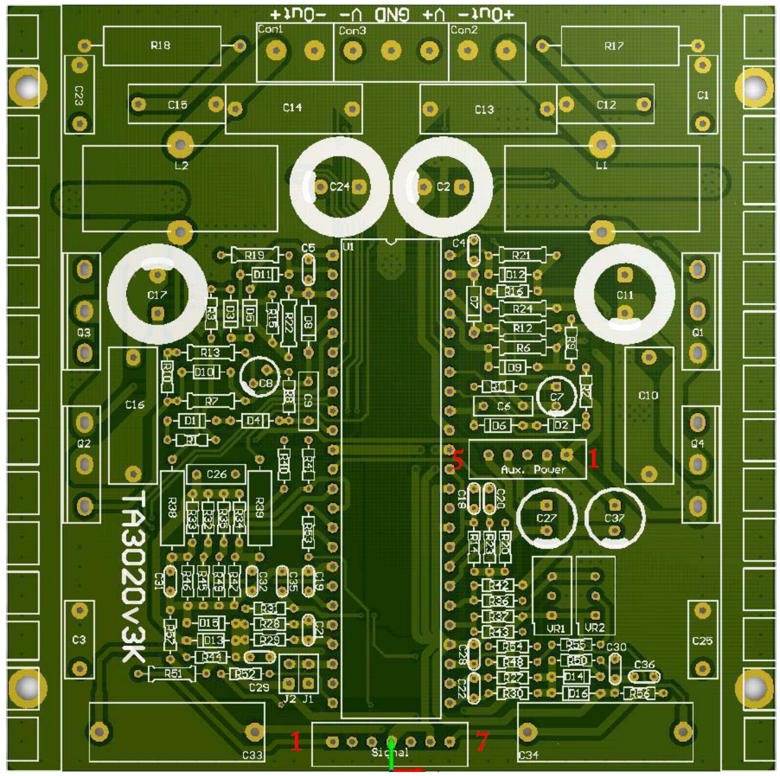

Figure 6: TA3020v3k Board layout overview and connections

The power MOS-FET transistors requires at least one heat sink for proper heat dissipation. This can be mounted on the bottom of the board, under the power MOS-FET transistors for the basic version, without heatsink. This allows more flexibility in installation, since any flat aluminum surface which can offer the required thermal resistance can be used. Thus, the amplifier module can be installed directly on the bottom of the enclosure, if this is thick enough to ensure cooling.

The heatsink version, comes with two 100x50x18mm vertical fins heatsinks, like the ones from the Figure 7. The heatsinks are mounted directly on the PCB and does not require additional support if the amplifier is installed in a suitable enclosure.

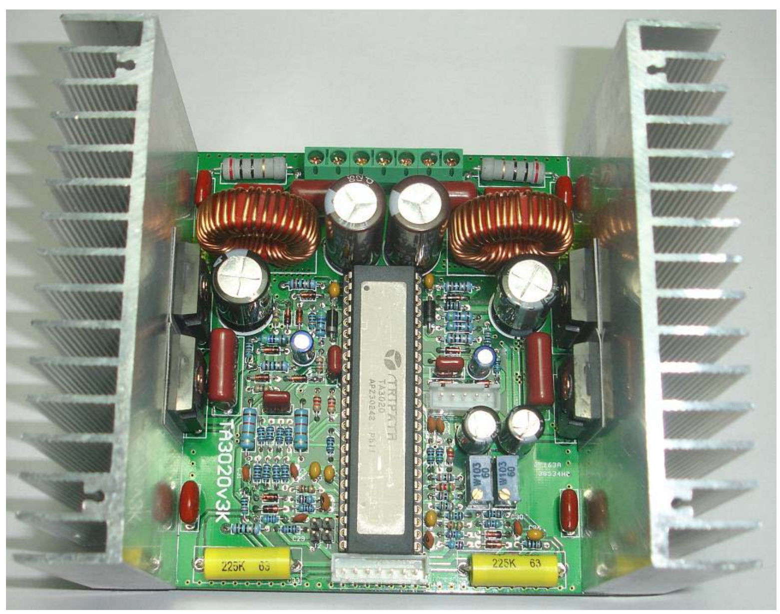

Figure 7: TA3020v3k Board heatsink version overview

The TA3020v3k kit comes in two main versions:

- Basic version, unassembled kit, with all the necessary components for assembly a complete working kit
- Complete assembled and tested version, as can be seen in Figure 1 or Figure7.

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The TA3020v3k BOM is available on the next table; please note that the values for some components might differ from one version to another, since the optimal values were chosen for each particular version.

TA3020 V3K BOM

Designator	Value	Designator	Value	Designator	Value
C1	220n	D3	4148	R22	4R7
C2	220uF	D4	4148	R23	15K
C3	220n	D5	4148	R24	4R7
C4	100n	D6	4148	R25	6mR
C5	100n	D7	MUR120	R26	6mR
C6	100n	D8	MUR120	R27	47K
C7	10uF	D9	4148	R28	68K
C8	10uF	D10	4148	R29	47K
C9	100n	D11	4148	R30	68K
C10	220n	D12	4148	R31	1M
C11	220uF	D13	4148	R32	1K
C12	220n	D14	4148	R33	1K
C13	470n	D15	4148	R34	1K
C14	470n	D16	4148	R35	1K
C15	220n	Q1	STW34NB20	R36	1M2
C16	220n	Q2	STW34NB20	R37	430K
C17	220uF	Q3	STW34NB20	R38	12K
C18	220p	Q4	STW34NB20	R39	12K
C19	100n	R1	4R7	R40	12K
C20	220p	R2	4R7	R41	12K
C21	47p	R3	4R7	R42	390K
C22	47p	R4	6mR	R43	390K
C23	220n	R5	6mR	R44	47K
C24	220uF	R6	4R7	R45	1K
C25	220n	R7	4R7	R46	1K
C26	100n	R8	221	R47	1K
C27	100uF	R9	100K	R48	1M
C28	100n	R10	100K	R49	1K
C29	470p	R11	221	R50	47K
C30	470p	R12	4R7	R51	10R
C31	390p	R13	4R7	R52	1K
C32	470p	R14	15K	R53	1K
C33	2u2	R15	100K	R54	100K
C34	2u2	R16	100K	R55	100K
C35	100n	R17	20R	R56	100K
C36	100n	R18	20R	R57	100K
C37	100uF	R19	4R7	U1	TA3020
D1	4148	R20	8K2	VR1	103
D2	4148	R21	4R7	VR2	103

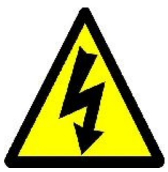
The Signal input connector pinout is as follows:

- Pin 1: aux. 5V output.
- Pin 2: Mute In – a logic 1 on this pin will bring the amplifier in Mute state.
- Pin 3: Mute Status – this pin will toggle to logic 1 is when the amplifier is Muted
- Pin 4: GND Signal
- Pin 5: Input Left – audio signal Input Left
- Pin 6: GND Signal
- Pin 7: Input Right – audio signal Input Right

The Aux. supply connector pinout is as follows:

- Pin 1: Vnn+10V for Driver Stage. **Supply 10.5 to 12V with respect to Vnn not GND !!!**
- Pin 2: Vnn
- Pin 3: Not connected, leave unconnected.
- Pin 4: +5V supply.
- Pin 5: GND for +5V supply.

The Power connector pinout is marked on the PCB.



Warning:

Before you proceed with assembly or installation, make sure you have read this:

Important note: The kit is only recommended to those who have proper electronic knowledge and skills, able to read and understand a schematic, familiar with electronic components, measuring and testing procedures. and should be aware that very dangerous voltages in excess of 100V DC are present on the board, and should take all the necessary safety measures when assembly and test. The minimum required equipment consist of a quality digital multimeter, an average analog or digital oscilloscope, and all the necessary tools for assembly, including soldering tools. Any ignorance of this warning will be made on user's responsibility, and can lead to serious injuries and possible death by electrocution if is handled improperly. A safety clearance of at least 6mm must be kept between the board and the case, or any conductive part of the amplifier. The heat transfer between the heatsinks and ambient must not be obstructed for proper operation. Use proper wire gauge wires for interconnection, with intact isolation, and as thick and short as possible. Use different colors for different polarities, respecting the standards and never touch the wires by hand or tools. Ignoring this recommendation can cause power supply failure, injuries or fire !!!

The TA3020v3k kit version comes unassembled, as a bare PCB with all components, leaving the user's pleasure (and frustration when something goes wrong) to assembly the kit. The kit is only recommended to those who have proper electronic knowledge, skills and equipment and have read this document thoroughly at least one time, and should be aware that very dangerous voltages in excess of 100V DC are present on the board, and should take all the necessary safety measures when assembly and test.

Disclaimer:

The TA3020 Audio Amplifier Module shall be used according with the instructions provided in this document. The user should NOT attempt to modify or change any of the parameters of this product, which can lead to malfunction. The designer and manufacturer of the product, **PCBstuff**, and the official distributor, **Connexelectronic**, will not be liable for any kind of loss or damage, including but not limited to incidental or consequential damages. Due to the high level of voltages on this board, the user should take all the caution measures needed when working with high voltage levels, should not touch any unisolated part of the board or connectors, or short-circuit any part of the board or connectors. Any misusage will be made on user responsibility.

The designer and manufacturer **PCBstuff** reserve the right to make changes or modifications on both the product functions and performances without notice. The TA3020 Audio Amplifier Module schematic and PCB design is **PCBstuff** proprietary and shall not be distributed, copied or published without the **PCBstuff** written agreement. **PCBstuff** and **Connexelectronic** reserve the right to offer limited support for the boards purchased directly from **PCBstuff** or **Connexelectronic**, and no support at all for the similar boards which aren't purchased directly from **PCBstuff** and **Connexelectronic**, or future listed resellers, and from various reasons they look or pretend to be similar or exactly same products. **Purchasing the product means that you are aware and agree with all this conditions.**