# 2*100W@4Ω TK2050
# Class-D Audio Amplifier Board
# User's Guide

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**NOTES:**

**Product Version : Ver 1.0**

**Document Version : Ver 1.0**

# 2*100W @4Ω TK2050 CLASS-D AUDIO AMPLIFIER BOARD USER'S GUIDE

# Chapter 1. Overview

## 1.1 Overview

Welcome to use this 2*100W Class-D audio amplifier board by Sure Electronics. As an upgraded version of the original AA-AB013, this board integrates an external extensible interface to connect the matching product of a volume control board and a rotary encoder board for volume control. It's suitable for amplifier enthusiasts or hobbyists to finish a complete amplifier system.

This amplifier board integrates Tripath's high performance TC2000 and TP2050 chips supporting dual channel audio amplification. Powered by any DC voltage from 10V to 32V, this high efficiency amplifier board is capable of outputting up to 100W per channel. It can be used to drive 4Ω or 8Ω passive speakers.

TC2000 is a dual channel audio controller produced by Tripath using its patent Digital Power Processing technology (DPP$^{TM}$). Combined with switching power output stages TP2050, it can achieve class-T audio power amplification and 50W continuous average power per channel, as well as lower THD+N and higher S/N ratio.

For 100W power output, this amplifier board integrates one TC2000 chips and two TP2050 chips so that it supports dual-channel audio amplification of up to 100W each. Resistance and capacity components of high quality are used to gain the perfect timber, finally realize high S/N ratio, low THD+N, wide frequency response range etc.

In addition, auto fan control function is utilized so that the cooling fun will self-adjust its rotating speed when the temperature of chips is too high, ensuring the normal working of the chips, and will automatically shutdown when the temperature of chips keeps low, ensuring the fun's own long service life.

**FIGURE 1-1 FRONT VIEW**

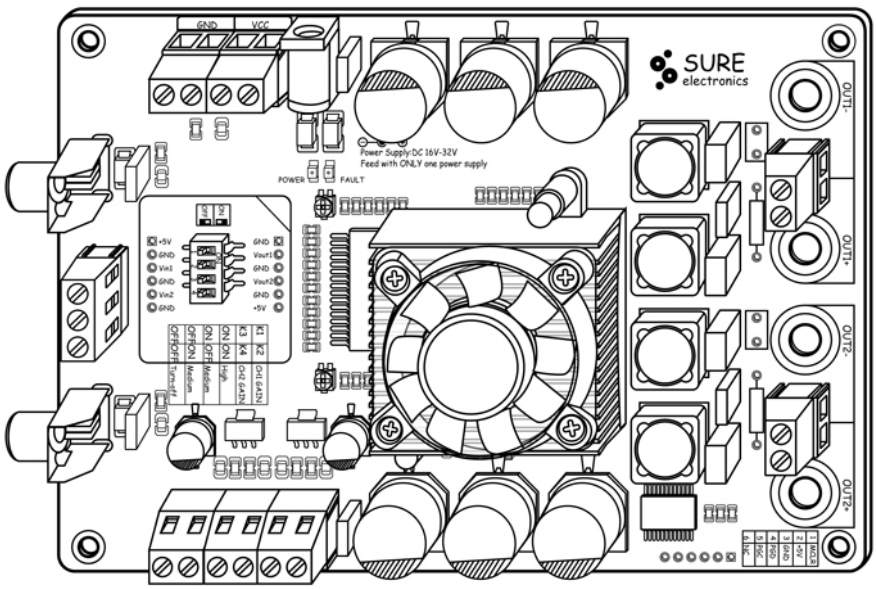
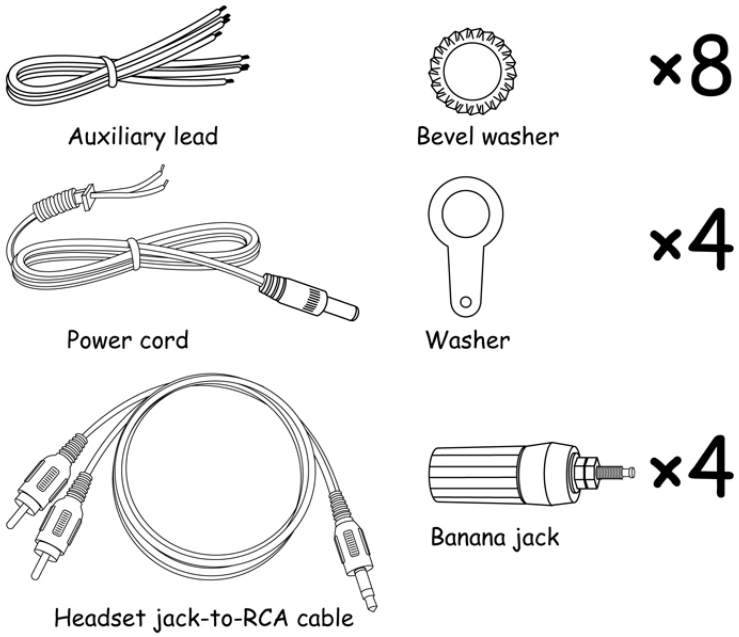


**FIGURE 1-2 ACCESSORIES**




**Note:** The diagrams above are used for reference only.

## 1.2 Features

- A perfect "Class D" architecture
- Wide power supply range: 12V to 30V, maximum 32V
- Frequency response: 20Hz to 20KHz(±3dB)
- Signal/Noise Ratio: 100dB(A-Weighted)
- High Output Power
  30W @ 6Ω, < 1% THD+N
  40W @ 8Ω, < 3% THD+N
  100W @ 4Ω, < 10.0% THD+N
- High Efficiency
  86% @ 60W 8Ω
  82% @ 46W 6Ω
  90% @ 100W 4Ω
- Audiophile Quality Sound
  0.007% THD+N @ 30W 8Ω
  0.005% THD+N @ 70W 4Ω
- Line level audio signal input
- Over/under voltage turn off
- Over current protection
- Over temperature protection

## 1.3 Applications

- Active Subwoofers
- Home Theater Receiver
- Multi-channel Distribution
- Active DVD System

- Mini/Micro Systems

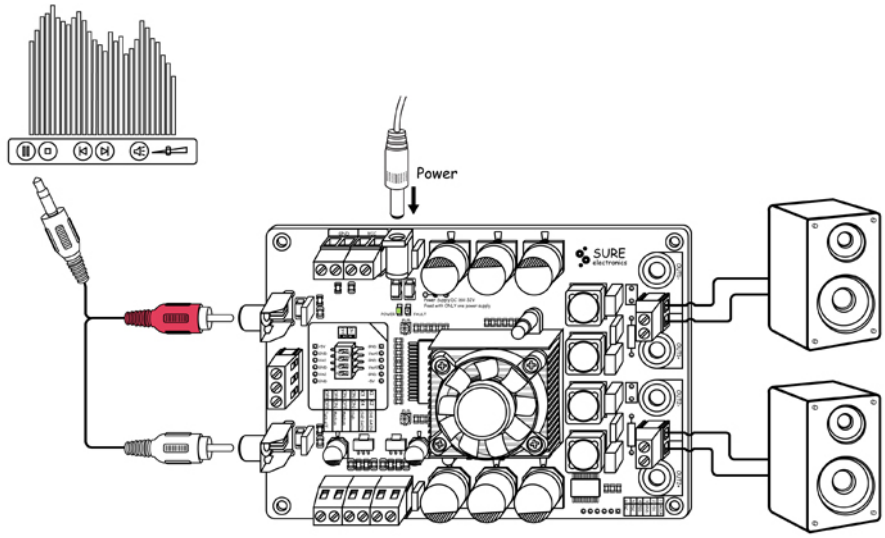
## 1.4 Benefits

- Mounting holes facilitate installation and fixing
- Several wiring methods facilitate connection
- Excellent design of the power ports which allows you to connect multiple amplifier boards in series.
- Excellent heat dissipation eliminates the requirement of an extra heat sink

## 1.5 Quick Start

Suggested connection is shown in figure 1-3.

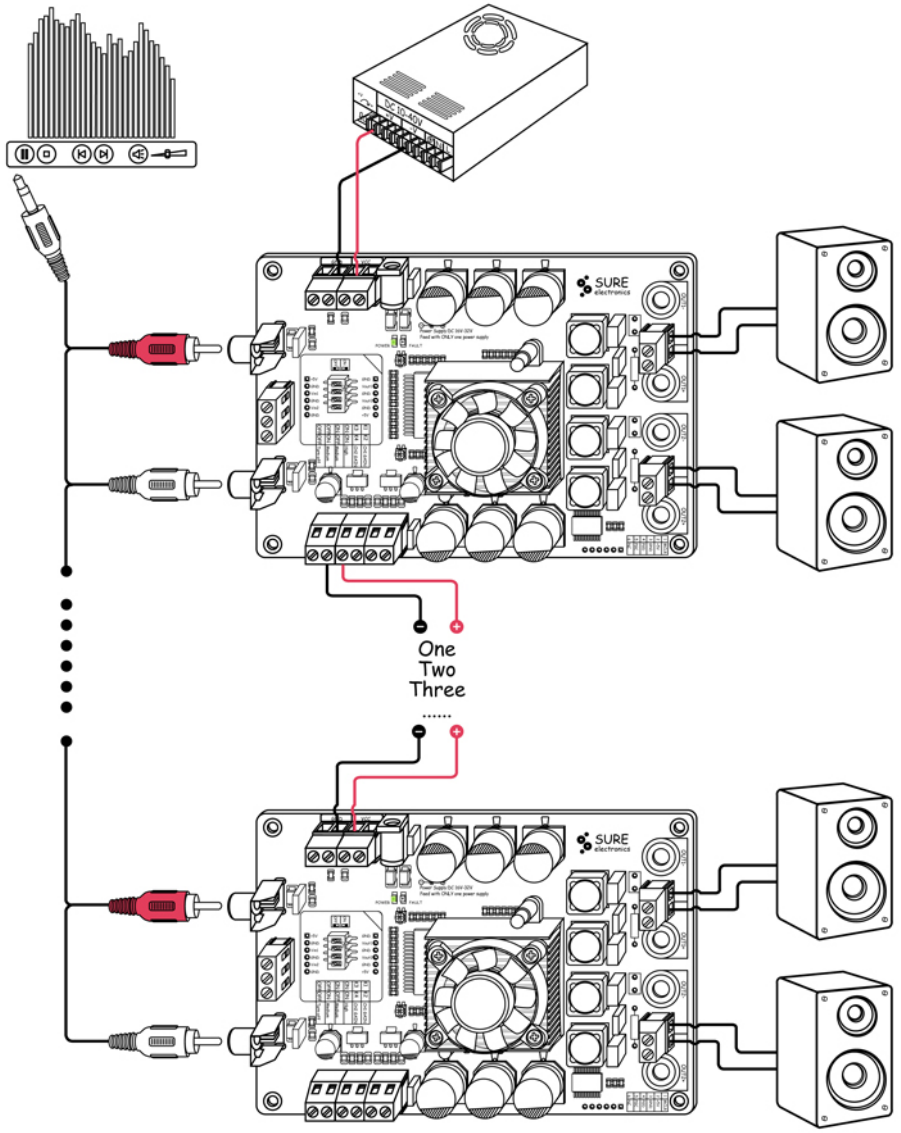
**FIGURE 1-3 CONNECTION SCHEMATIC**




**Note:** Please observe the following steps to complete verification so as to ensure the products are intact during transit.

1. Open the amplifier package and make sure the product is intact (No missing or damaged components and no deformation)
2. Please observe the connection schematics when connecting the amplifier board. Use a nearby sound source, such as MP3 or CD player to have a trial. This amplifier board can be deemed as qualified if you can hear the sound corresponding to that sound source.

**FIGURE 1-4 CASCADING SCHEMATIC**




**Note:** GND should be grounded or connected to the housing of the device.

# Chapter 2. Hardware Detail

## 2.1 Power Connection

To power the amplifier board, use either jack or terminal blocks. Pay attention to the polarity when connecting power supply.

**FIGURE 2-1 POWER CONNECTION**

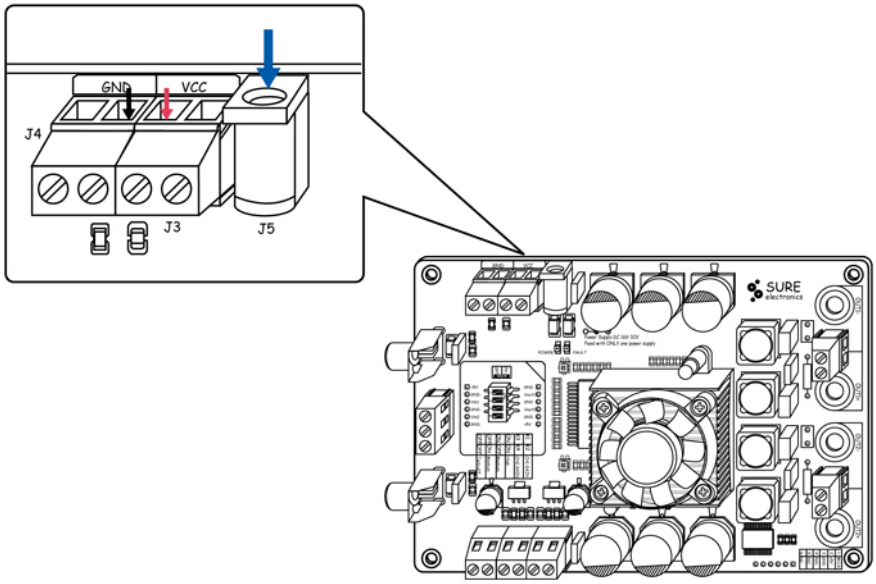



**TABLE 2-1 POWER CONNECTION**

| Connector Mark | | | Description |
|---|---|---|---|
| Jack | J5 | | DC 10V to 32V power supply |
| Terminal Blocks | J3 | VCC | The positive of DC 10V to 32V power supply |
| | J4 | GND | The negative of DC 10V to 32V power supply |

**Note:**
1. You are allowed to use only one way to power the amplifier board at a time.
2. The maximum supply voltage shall not exceed 36V.

## 2.2 Input Connections

You may use RCA connectors to input audio signal.

**FIGURE 2-2 INPUT CONNECTION**

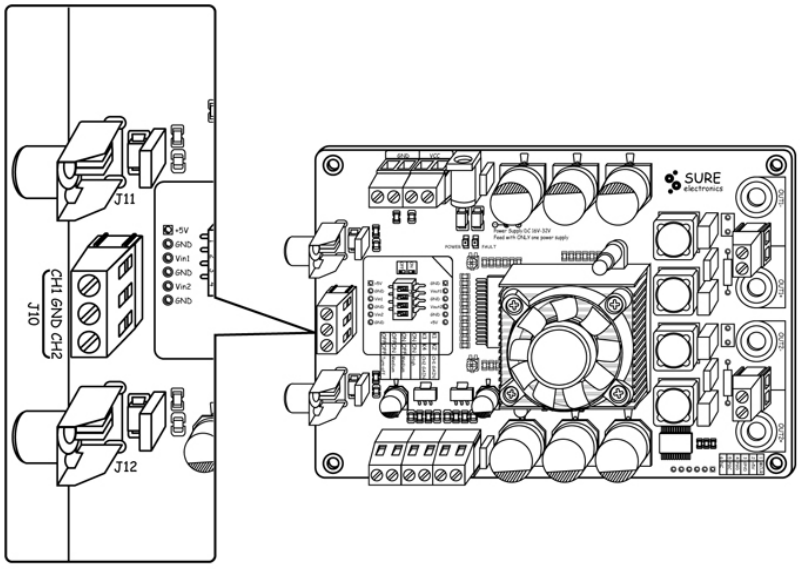



**TABLE 2-2 INPUT CONNECTION**

| Connector Mark | | Channel Description |
|---|---|---|
| RCA connector | J11 | Channel 1 Input |
| | J12 | Channel 2 Input |
| Terminal Blocks | J10 | Channel 1 Input |
| | | GND |
| | | Channel 2 Input |

**Note:** You are allowed to feed only one group (dual channel) of audio signal to the amplifier board at a time.

## 2.3 Output Connections

You can use either terminal blocks or banana connectors to output audio signal. Two pairs of banana jacks are provided for free.

**FIGURE 2-3 OUTPUT CONNECTION**

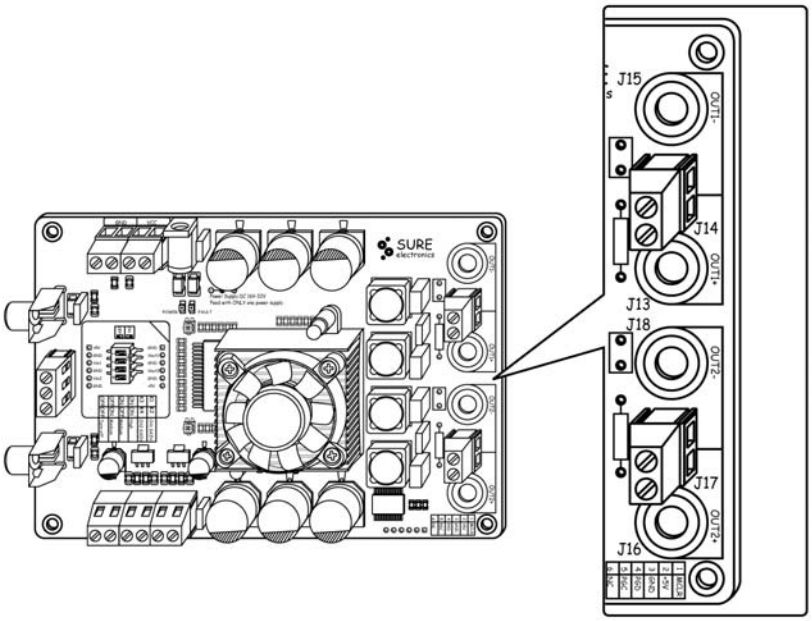


**TABLE 2-3 OUTPUT CONNECTION**

| Connector Mark | | Description |
|---|---|---|
| Banana Connectors | J15 | Negative Output of Channel 1 |
| | J13 | Positive Output of Channel 1 |
| | J18 | Negative Output of Channel 2 |
| | J16 | Positive Output of Channel 2 |
| Terminal blocks* | J14 | Output of Channel 1 |
| | J17 | Output of Channel 2 |

**Note:**
1. Never connect more than one group of speaker to the audio output.
2. Never connect CH1_OUT- 、CH2_OUT- together since they belong to different NETs
3. * Refer to on-board descriptions for connection details.

## 2.4 DC Offset

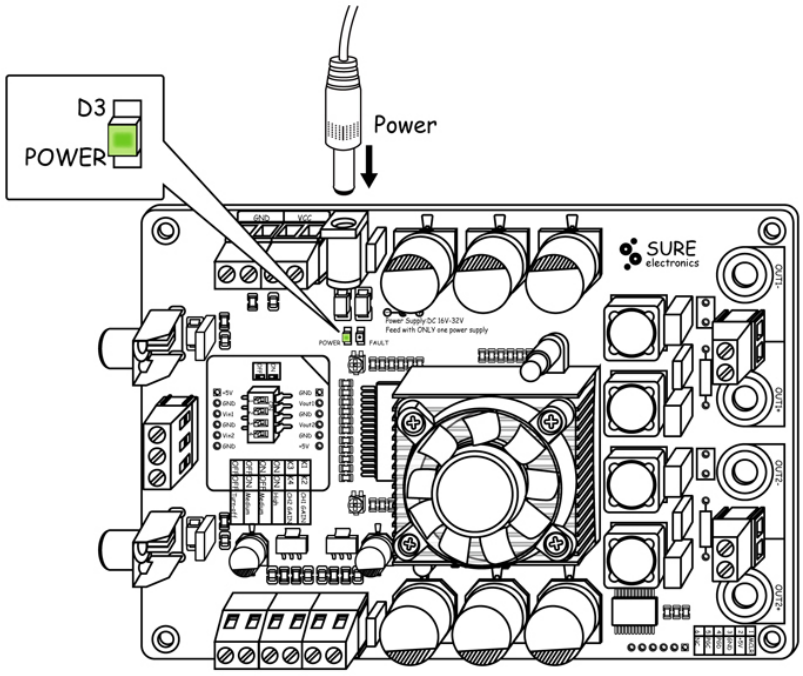
If it is not quite necessary, DO NOT trim the output offset by adjusting “R16” and “R35” on the board since the output offset has been regulated to a range of ±10mV.

**Note:** Never adjust these potentiometers unless necessary, improper adjustment may damage your speakers.

## 2.5 LED Indicators

This amplifier has two power LED indicators which are respectively marked as “Power (D3)” and “FAULT (D5)”. “Power (D3)” will be illuminated in green when power-up. “FAULT (D5)” will be illuminated in blue when the board works in SLEEP mode or there’s error. Please refer to the connection schematic of the board for the LED location and refer to the manual of TK2050 for details of “FAULT”.

**FIGURE 2-4 LED INDICATOR**




**Note:** When power on, the “FAULT (D5)” will twinkle for a short time. However, it doesn’t affect use.

## 2.6 Volume Control

The on-board external extensible interface allows for the connection of a rotary encoder board and a volume control board for volume control. The two boards are not provided here but as another product (product No.: AA-AA11117) sold on Sure's webstore. If you use the two boards, please set K1, K2, K3 and K4 of the on-board DIP switch OFF. Not using these two boards, you may also adjust the volume by setting the DIP switch.

**FIGURE 2-5 VOLUME CONTROL**

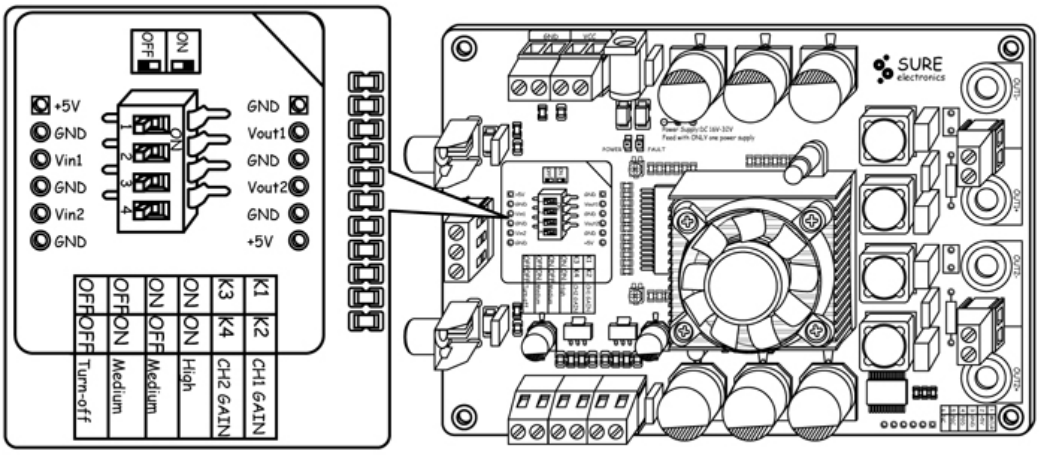



**TABLE 2-8 DIP SWITCH SETTING**

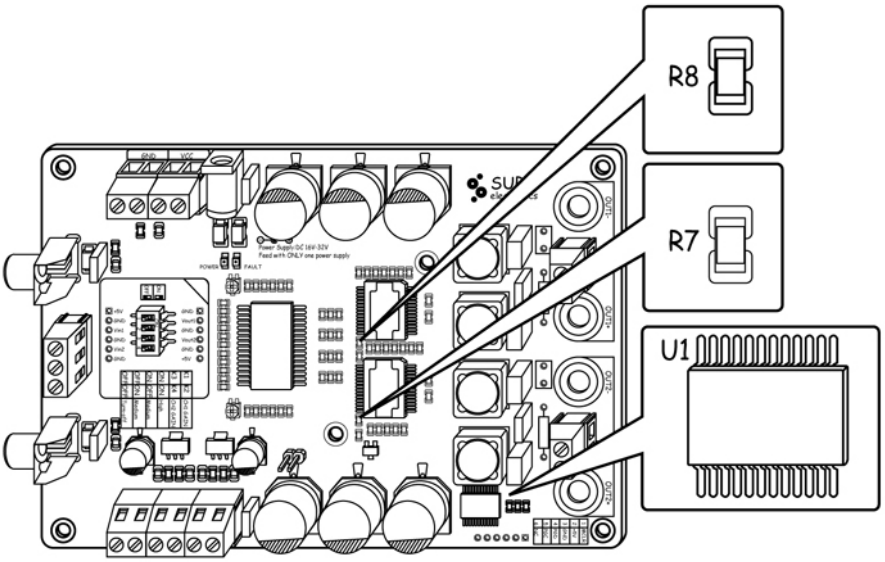
| Switch | K1 | K2 | Function | Switch | K3 | K4 | Function |
|---|---|---|---|---|---|---|---|
| CH1 | ON | ON | HIGH | CH2 | ON | ON | HIGH |
| | ON | OFF | MEDIUM | | ON | OFF | MEDIUM |
| | OFF | ON | MEDIUM | | OFF | ON | MEDIUM |
| | OFF | OFF | TURN-OFF | | OFF | OFF | TURN-OFF |

**Note:** Please be aware that audio clippings may occur to some portable players because of the audio source not the amplifier itself. The sensitivity of this amplifier is 0.775VRMS and the audio signal of the same level should be input.

## 2.7 Temperature Control

To ensure the amplifier chips can work in a good environment, the amplifier board integrates one PIC16F690 (U1) and two thermistors (R7, R8). R7 and R8 are used for real-time detection to the temperature around the driver chips. U1 obtains the information from the thermistors and accordingly control the fan installed. When the ambient temperature or the temperature of chips is too high, the fan used will automatically adjust its rotating speed to reduce the temperature. When the ambient temperature and the temperature of chips are low, the fan will automatically shutdown to extend the service life.

**FIGURE 2-6 U1, R7 AND R8**




## 2.8 Notes

In order to protect amplifier board and extend its service lifetime, please read the following warnings carefully since warranties will be voided if you do not observe the following warnings:

***Warning 1:***

Quality-related issues caused by potentiometers installed by buyers.

***Warning 2:***

In order to achieve a better sound quality, please use stable power supply since a bad or unstable power supply may worsen the sound quality or even cripple the amplifier board.

***Warning 3:***

Never equip a pre-amplifier to the audio input since the amplifier itself has powerful amplification ability and a high signal input will burn out the amplifier chip.

***Warning 4:***

In order to protect amplifier and speaker, please turn the volume output to the minimum when hooking up the amplifier and you may readjust the volume when you are sure that the amplifier is functioning properly.

# Chapter 3. Electrical Characteristics

Following table lists all typical data. For full specification, please refer to the data sheet of Tripath's TK2050 chip.

**TABLE 3-1 ELECTRICAL CHARACTERISTICS**

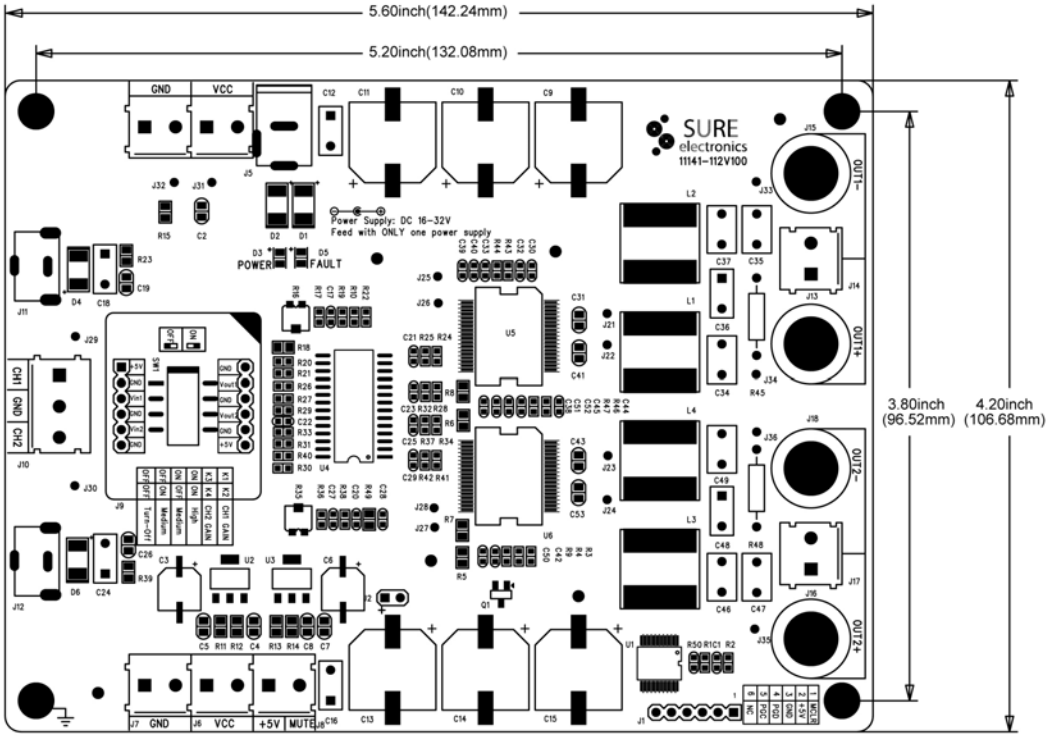
| Parameter | | Condition | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Supply Voltage | | - | 10V | 24V | 32V |
| Shutdown Current* | | - | 7A | 12A | 16A |
| Quiescent Current | | DC12V, no load | - | 100mA | - |
| | | MUTE=0 | - | 10mA | 40mA |
| Signal/Noise Ratio | | - | 90dB (A-weighted) | 100dB (A-weighted) | - |
| Input Sensitivity | | A=0dB | 0.720V | 0.771V | 0.800V |
| THD+N* | | $R_L$=4Ω, $P_{out}$=70W | - | 0.010% | - |
| | | $R_L$=8Ω, $P_{out}$=30W | - | 0.007% | - |
| Frequency Range | | - | 20Hz to 20KHz（±3dB） | | |
| Efficiency@ VCC=32V | | $R_L$=4Ω, $P_{out}$=117W | | 86% | |
| | | $R_L$=4Ω, $P_{out}$=46W | - | 82% | - |
| | | $R_L$=8Ω, $P_{out}$=60W | - | 88% | - |
| Output Power | THD+N<0.01% | $R_L$=4Ω, f=1000Hz | - | 50W | - |
| | | $R_L$=8Ω, f=1000Hz | - | 35W | - |
| | THD+N<10% | $R_L$=4Ω, f=1000Hz | - | 100W | - |
| | | $R_L$=8Ω, f=1000Hz | - | 60W | - |
| Input Impedance | | - | 11K | 22K | - |
| Offset Voltage (adjustable) | | | -10mV | 0mV | 10mV |
| Minimum Load | | - | 3.2Ω | - | - |
| Channel Separation* | | Po=100W, $R_L$=4ohm | 80dB | 95dB | - |
| Power Gain* | | - | 14V/V | 16V/V | 18V/V |
| Operating Temperature | | - | 0℃ | 20℃ | 50℃ |
| Storage Temperature | | - | -20℃ | 20℃ | 105℃ |

| | | | | |
|---|---|---|---|---|
| Thermal Warning* | - | - | 130℃ | - |
| Thermal Shutdown | - | - | 150℃ | - |

**Note:** *The chip's specifications from Tripath's TK2050 Data Sheet.

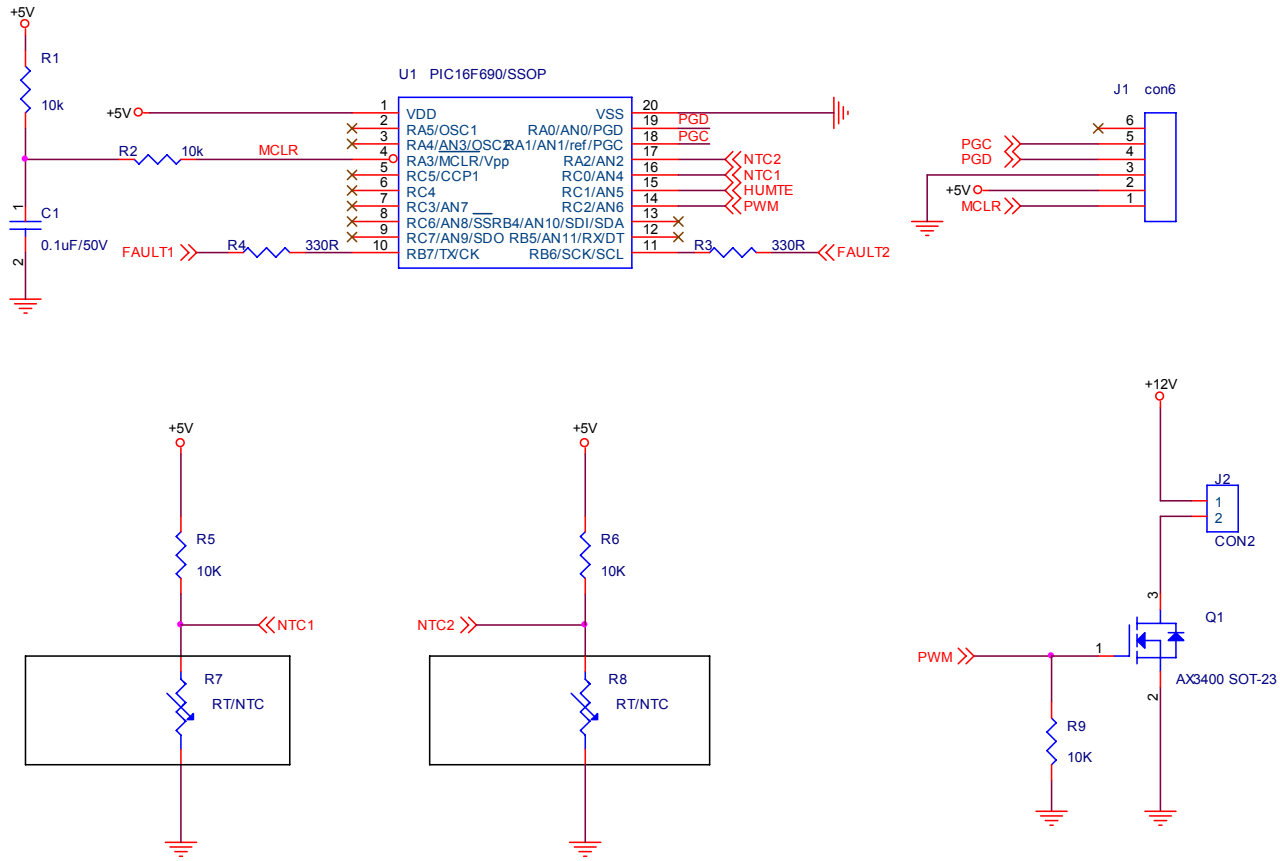
# Chapter 4. Mechanical Drawing

**FIGURE 4-1 MECHANICAL DRAWING**



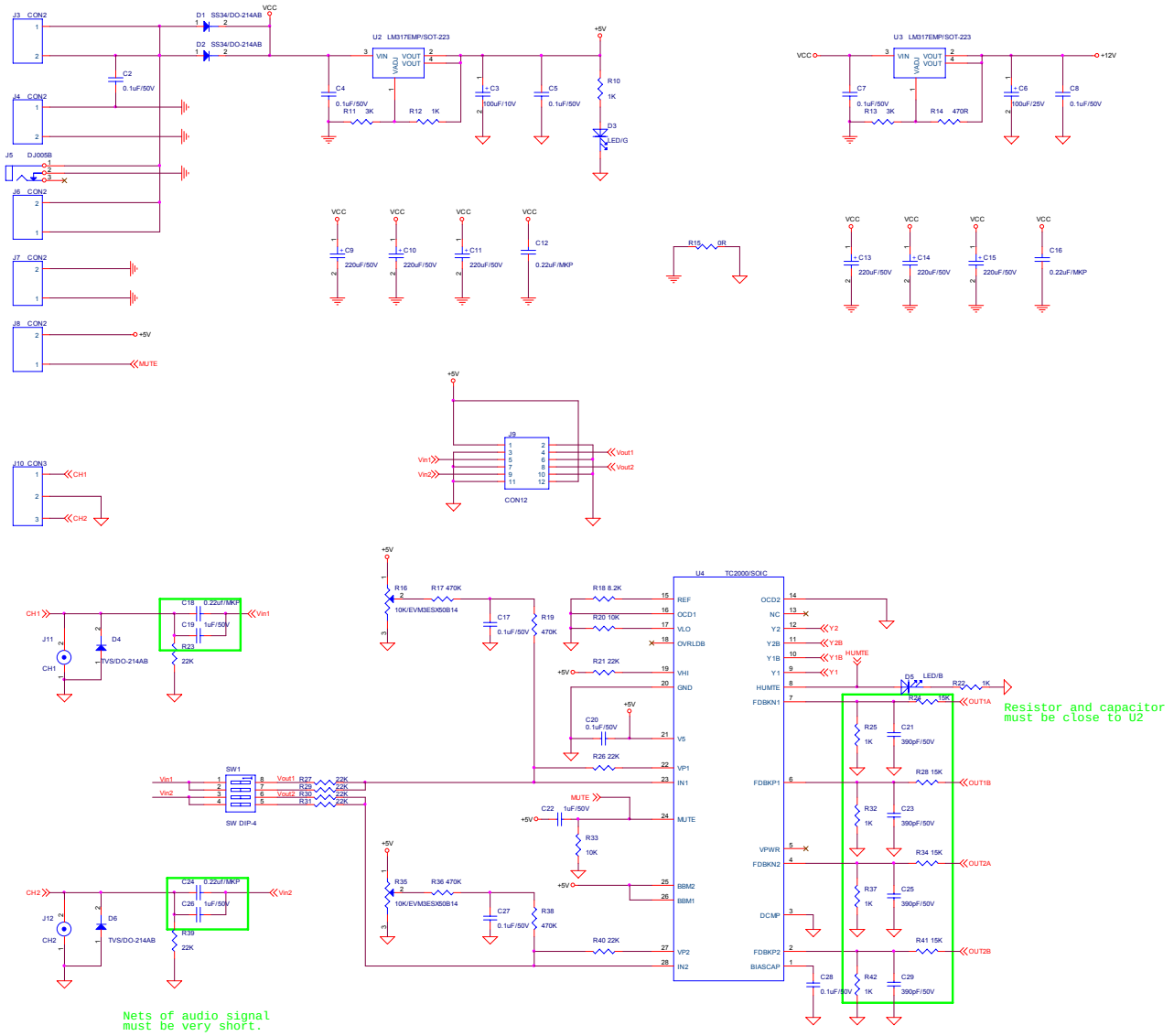
# Chapter 5. Appendix

**FIGURE 5-1 SCHEMATIC 1**

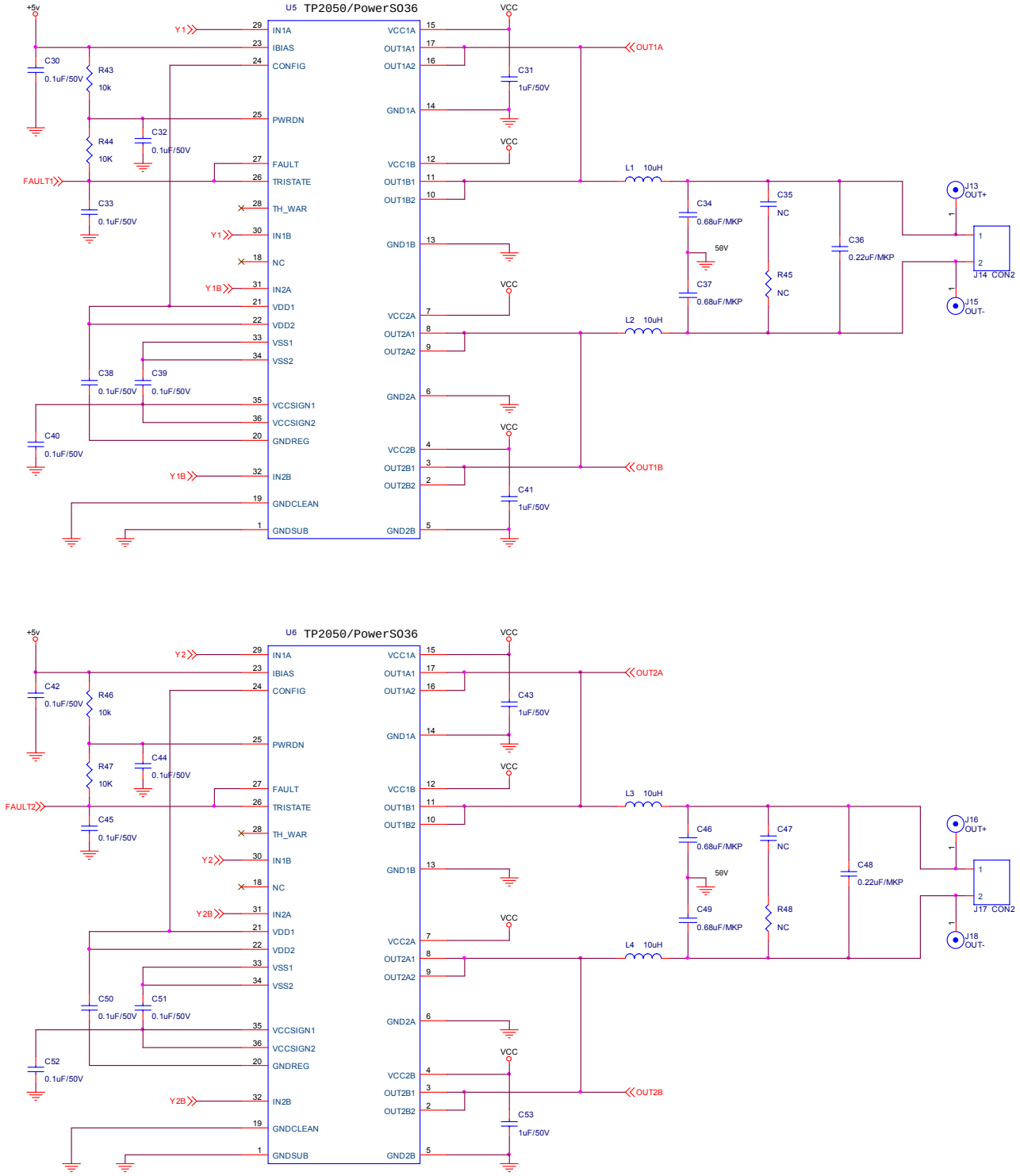



**Note:** All the schematics in this chapter are used for reference only. There might be a tiny difference in production batch.

## FIGURE 5-2 SCHEMATIC 2



## FIGURE 5-3 SCHEMATIC 3



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