# 2*25W@4Ω TPA3123
# Class-D Audio Amplifier Board
# User's Guide

# Table of Contents

**NOTES:**

**Product Version** : **Ver 1.0**

**Document Version** : **Ver 1.0**

# Chapter 1. Overview

## 1.1 Overview

Welcome to use this 2*25W amplifier board from Sure Electronics. Sure has developed many Class-D amplifiers such as 0.5W, 2W, 8W, 15W, 50W, 100W and one-channel, dual-channel, four-channel amplifiers to meet different requirements of customers. As a new member of class-D amplifier series, this 2*25W amplifier board employs TPA3123D2 chip from TI. It supports dual channel amplification and each such channel is rated at 25W which helps producing state-of-the-art sound quality. The efficiency of the TPA3123D2 eliminates the need for an external heat sink when playing music. Besides, integrating high-quality SMD and MKP plug-in capacitors ensures Hi-Fi amplification output.

This amplifier can readily be powered by any DC power supply ranging from +10 to 30V. You can use it to drive any 4Ω or 8Ω passive speakers. It's an ideal choice for electronic hobbyists and audio enthusiasts.

**FIGURE 1-1 PRODUCT DIAGRAM**

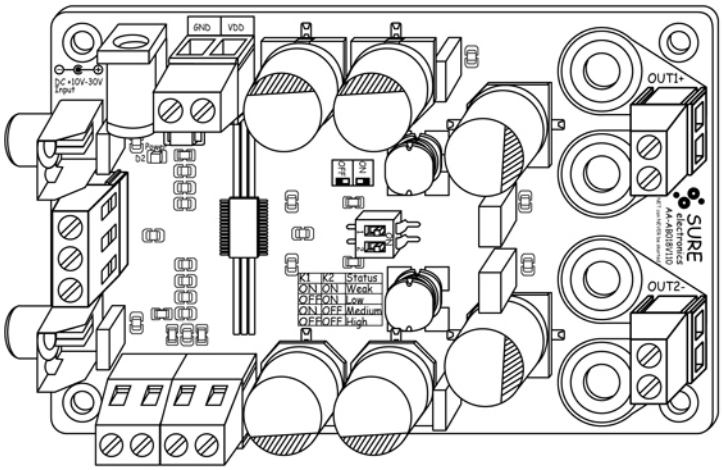
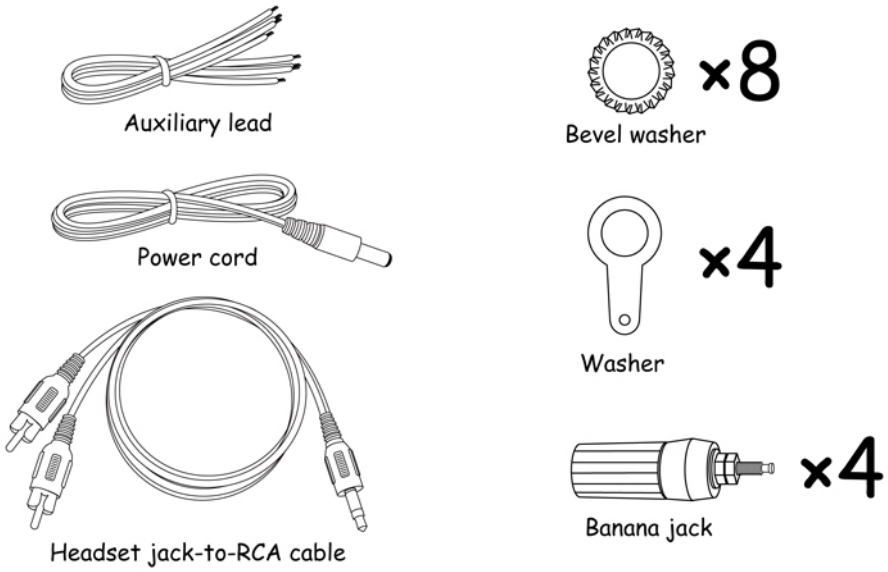


**FIGURE 1-2 ACCESSORIES**




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

## 1.2 Features

- A perfect "Class D" architecture
- Fully-bridged stereo output
- Wide power supply range: +10V-30V
- Two kinds of input: line level input and analog audio input
- Frequency response: 20Hz-20KHz(±3dB)
- Signal/Noise Ratio: 100dB(A-Weighted)
- High Output Power
  10W @ 8Ω, < 10.0% THD+N
  25W @ 4Ω, < 10.0% THD+N
- High Efficiency
  92% @ 8W 8Ω
  85% @ 16W 4Ω
- Audiophile Quality Sound
  0.08% THD+N @ 5W 8Ω
  0.08% THD+N @ 10W 4Ω
- Sensitivity and gain adjustable
- 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

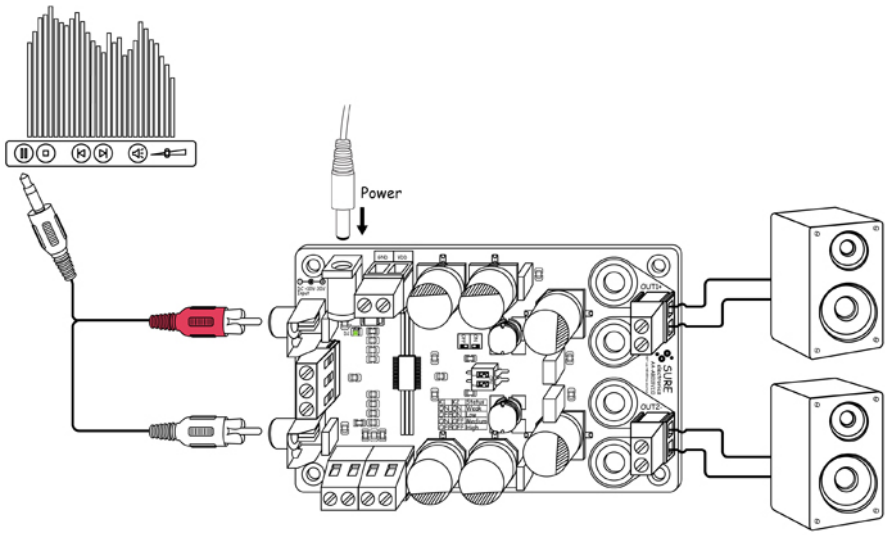
- Mounting holes facilitate installation and fixing
- Several wiring methods facilitate connection
- Excellent design of the power ports which allows you to cascade multiple amplifier boards (max 4 recommended)
- Excellent heat dissipation eliminates the requirement of an extra heat sink

**Note:** Output signal cannot be bridged again.

## 1.5 Quick Start

Suggested connection is shown in figure 1-3.

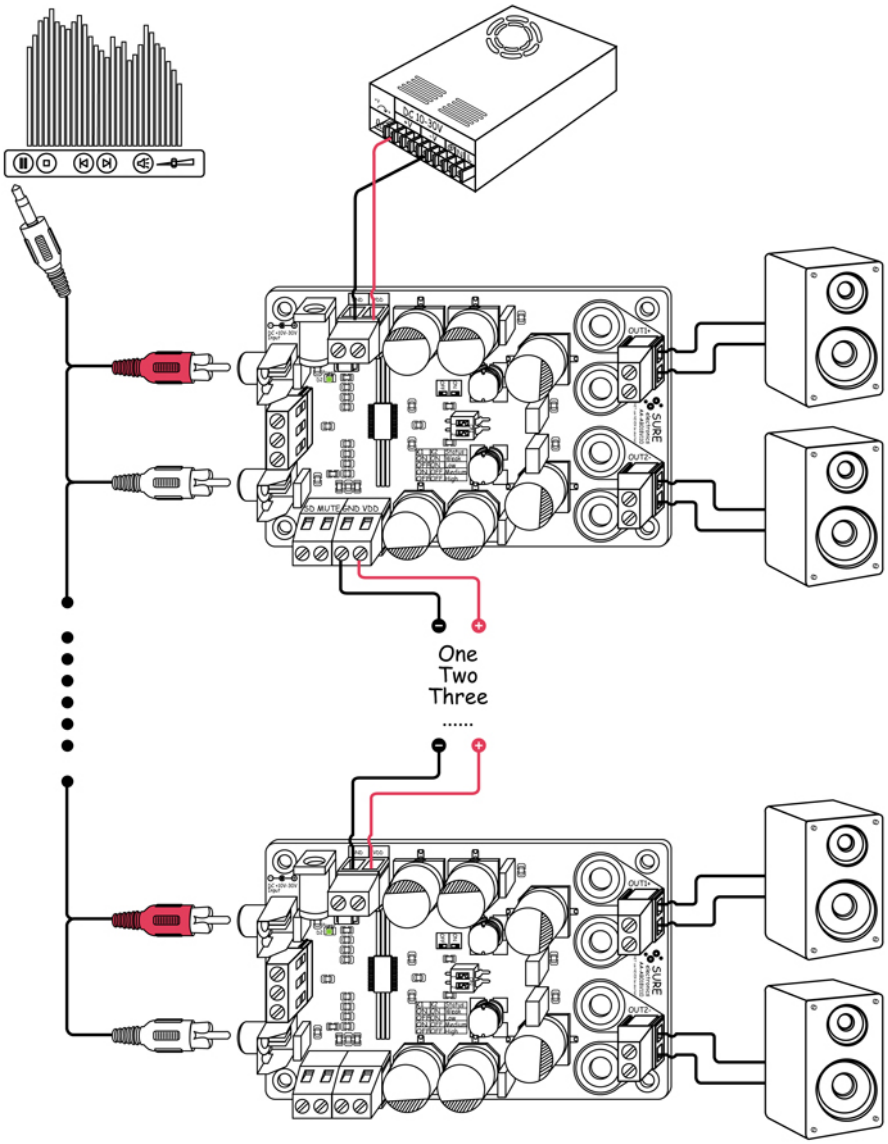
**FIGURE 1-3 CONNECTION SCHEMATIC**




**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. On-board diodes can prevent the consequence of wrong connection of power supply.

**FIGURE 2-1 POWER CONNECTION**

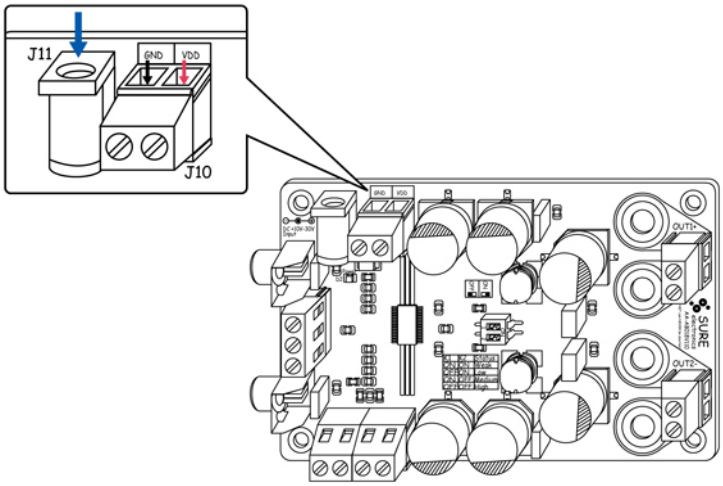



**TABLE 2-1 POWER CONNECTION**

| Connector Mark | | | Description |
|---|---|---|---|
| Jack | J11 | | DC 10-30V power supply |
| Terminal Blocks | J10 | VCC | The positive of DC 10-30V power supply |
| | | GND | The negative of DC 10-30V 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 30V.

## 2.2 Input Connections

You may use RCA connectors to input audio signal.

**FIGURE 2-2 INPUT CONNECTION**

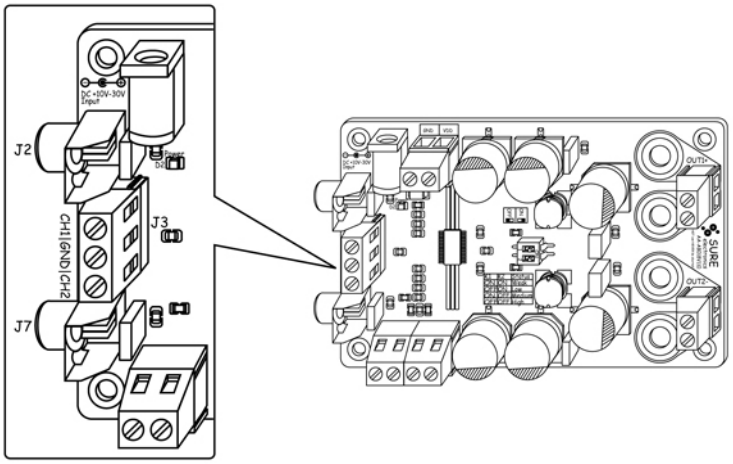



**TABLE 2-2 INPUT CONNECTION**

| Connector Mark | | Channel Description |
|---|---|---|
| RCA connector | J2 | Channel 1 Input |
| | J7 | Channel 2 Input |
| Terminal Blocks | J3 (PIN 1) | Channel 1 Input |
| | J3 (PIN 2) | GND |
| | J3 (PIN 3) | Channel 2 Input |

**Note:** You are allowed to feed only one group (dual channel) of audio signal to the amplifier board at a time. Please refer to 2.6 “Gain Setting” for details.

## 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 1**

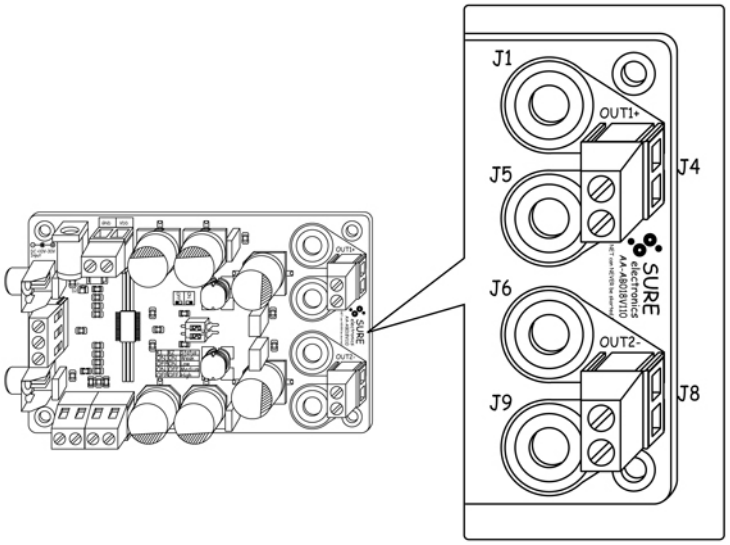
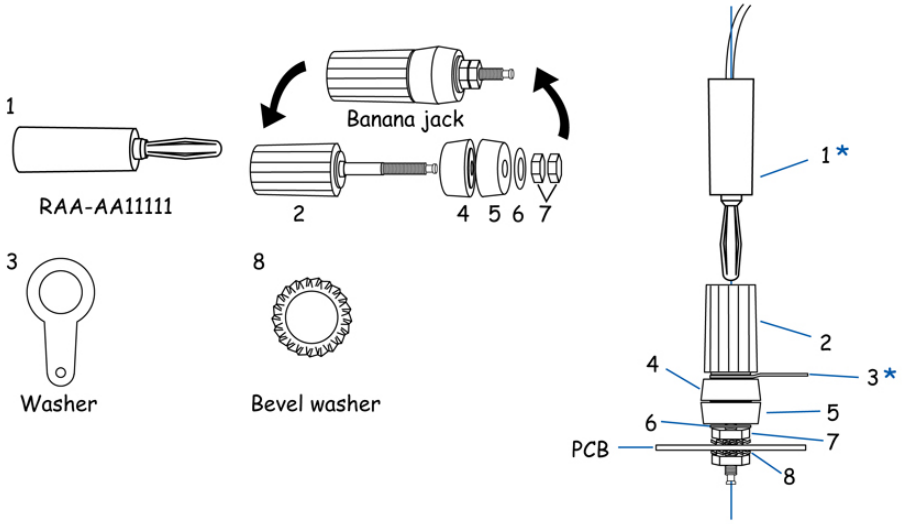


**FIGURE 2-4 OUTPUT CONNECTION 2**




**Note:**
1*: not provided here. It can be used together with banana jack ("2" above) facilitating wiring. You can click http://www.sureelectronics.net/goods.php?id=1036 for details.
3*: included in the accessories but selectable to be installed.

**TABLE 2-3 OUTPUT CONNECTION**

| Connector Mark | | Description |
|---|---|---|
| Banana Connectors | J1 | Positive Output of Channel 1 |
| | J5 | Negative Output of Channel 1 |
| | J6 | Negative Output of Channel 2 |
| | J9 | Positive Output of Channel 2 |
| Terminal blocks Refer to on-board descriptions for connection details | J4 | Output of Channel 1 |
| | J8 | Output of Channel 2 |

**Note:** Never connect more than one group of speaker to the audio output.

## 2.4 Connection with Next Board

J10 and J12 on terminal blocks are used to connect more amplifier boards.

**FIGURE 2-5 CONNECTION SCHEMATIC**

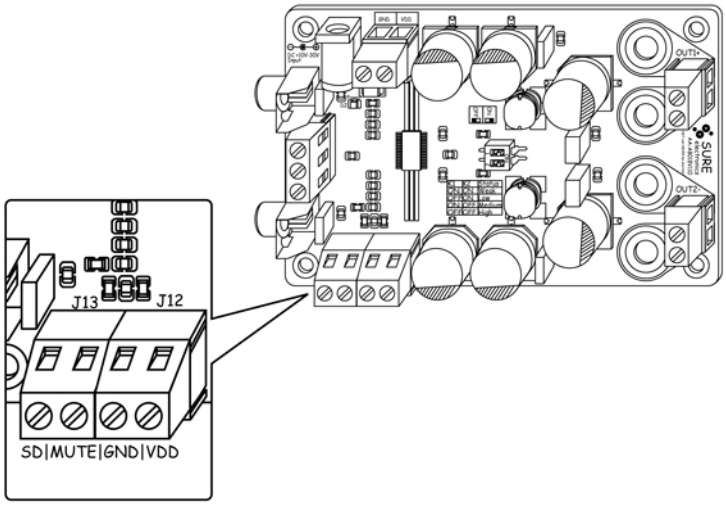


**TABLE 2-4 CONNECTION WITH NEXT BOARD**

| Connector Mark | | Description |
|---|---|---|
| J12 | VDD | Connect to Positive (+) of DC 10 to 36V Power Supply (J10) of the next board |
| | GND | Connect to Negative (GND) of DC 10 to 36V Power Supply (J10) of the next board |
| J13 | SD | Sleep Control |
| | MUTE | Mute Control |

**Note:**
1. Maximum 4 amplifiers are recommended to be connected in series.
2. Remember to use AWG12-compliant cable or equivalent for series connection.

## 2.5 Mute Settings

To mute the output audio signal, connect “VDD” and “MUTE” of the terminal block with a piece of lead. Usually, “MUTE” shall be left unconnected.

**FIGURE 2-6 MUTE SETTINGS**

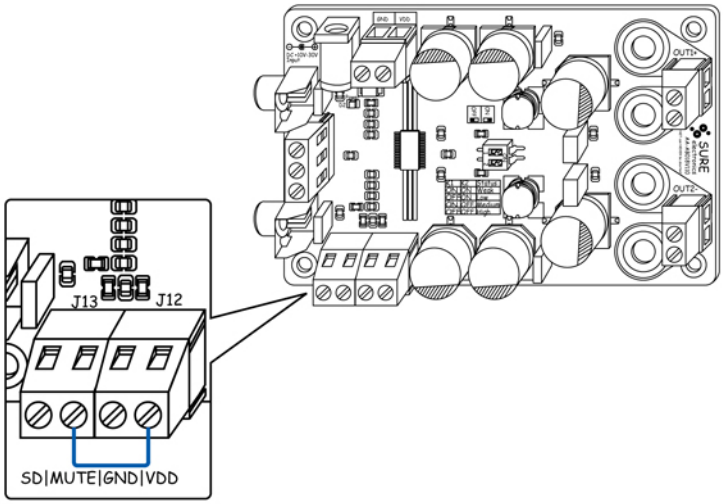



**TABLE 2-5 MUTE SETTINGS**

| Connector Mark | | Description |
|---|---|---|
| J13 | MUTE | When “MUTE” is connected with “VDD”, both channels will be muted and enter into idle mode. When connected to ground or left unconnected, both channels will resume regular operation. |

**Note:** Please power the amplifier board with DC 10-30V.

## 2.6 Sleep Settings

To enable sleep setting, connect “VDD” and “SD” of the terminal block with a piece of lead. Usually, “SD” shall be left unconnected.

**FIGURE 2-7 SLEEP SETTINGS**

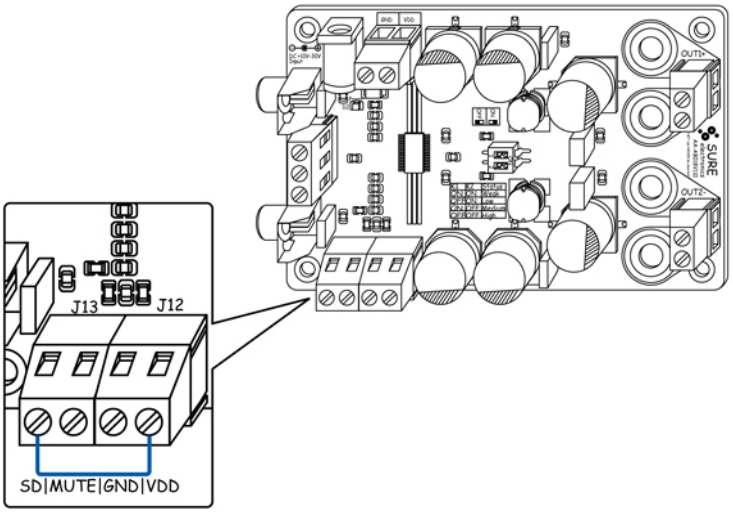



**TABLE 2-6 SLEEP SETTINGS**

| Connector Mark | | Description |
|---|---|---|
| J13 | SD | When “SD” is connected with “VDD”, both channels will be set to SLEEP and enter low-power-consumption working mode. When connected to ground or left unconnected, both channels will resume regular operation. |

**Note:** “SD” means that the chip works with low power consumption. “MUTE” means that the chip normally works with no output.

## 2.7 Gain Settings

The on-board 2-slide DIP switch, which is marked as “SW1”, is used to set the gain of amplifier board. The two slides are marked as K1, K2 respectively. The following table lists the gain values on different settings:

**FIGURE 2-8 GAIN SETTINGS**

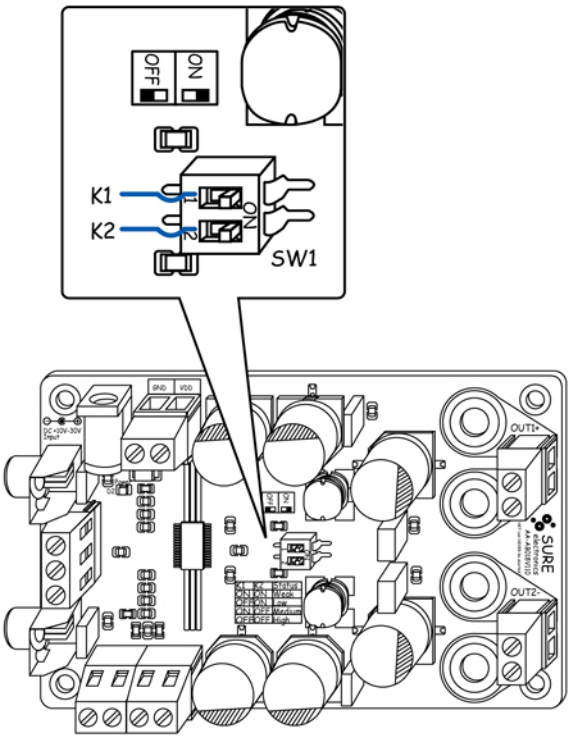



**TABLE 2-7 GAIN SETTINGS**

| Settings | | Amplification Gain | |
|---|---|---|---|
| K1 | K2 | Gain Level | Power Gain (dB) Typical |
| ON | ON | Weak | 20 |
| OFF | ON | Low | 26 |
| ON | OFF | Medium | 32 |
| OFF | OFF | High | 36 |

**Note:**

1. High: Portable MP3/CD player with built-in volume control
   Medium and low: General-purpose use
   Weak: Preamplifier with fairly high output signal
2. Different gain levels correspond to different input sensitivities. Improper selection will cause the audio distortion or even damage the amplifier board.
3. No preamplifier or other devices are needed for gain settings. We won't assume any responsibility for the damage caused by connecting extra devices.

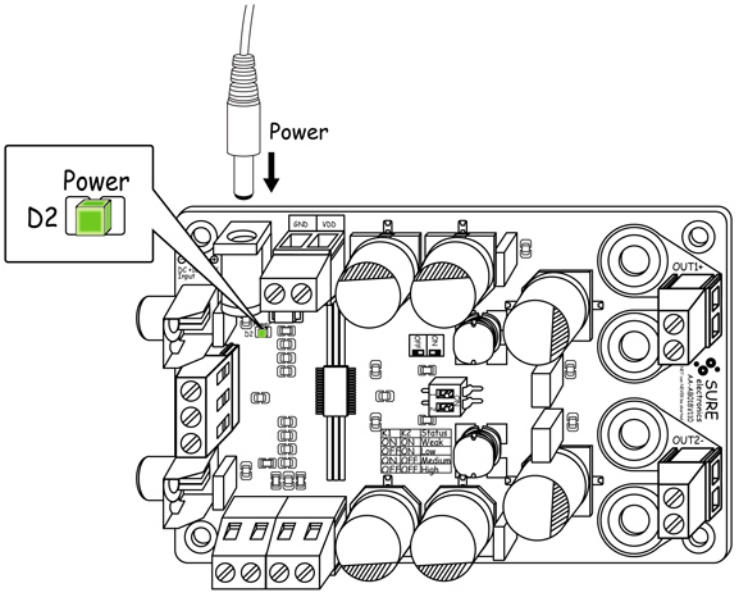
## 2.8 DC Offset

Capacitive coupling output is applied to ensure no DC offset output.

## 2.9 LED Indicators

This amplifier has one power LED indicator which is marked as "Power (D2)". The power indicator will be illuminated in green when power-up. Please refer to the connection schematics of the board for the LED location.

**FIGURE 2-9 LED INDICATOR**




## 2.10 Volume Control

No potentiometer is provided for manually adjusting the volume. The volume control of sound source like MP3 player or PC can be used to adjust the loudness of the audio output or a 50KΩ potentiometer can be installed by users themselves, but it may cause signal attenuation. To compensate that attenuation, adjusting the gain value is required. You may refer to 2.7 Gain setting for details.

Please be aware that audio clippings may occur to some portable players because of the audio source not the amplifier itself. Please increase the input gain of amplifier board.

## 2.11 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 TI data sheet of TPA3123 chip.

$T_A$=20℃, DC24V, f=1000Hz, Sine wave input, $R_L$=4Ω, Gain=20dB (unless otherwise stated)

**TABLE 3-1 ELECTRICAL CHARACTERISTICS**

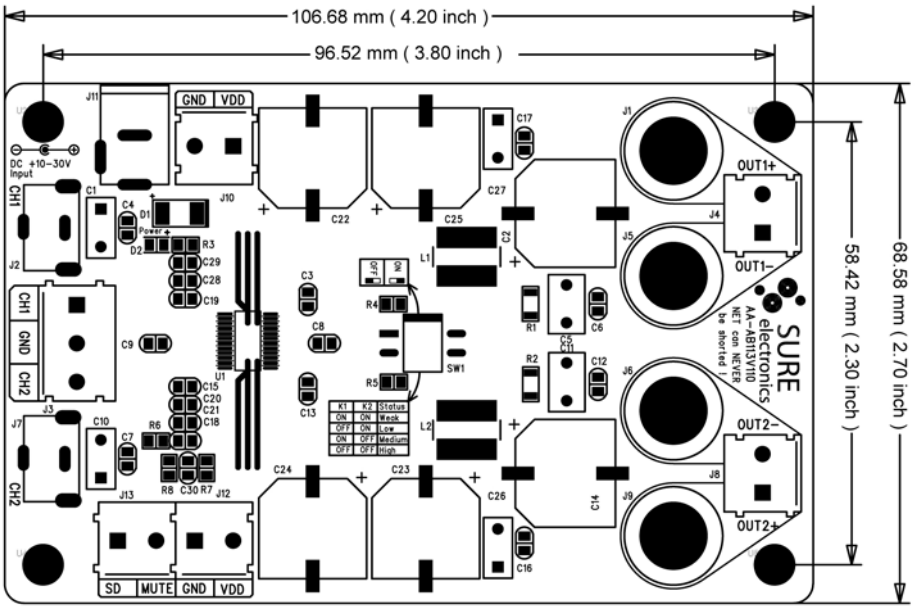
| Parameter | | Condition | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Supply Voltage | | - | 10V | - | 30V |
| Supply Current | | - | - | - | 2A |
| Signal/Noise Ratio | | - | 90dB | 100dB | - |
| Input Sensitivity | Gain＝36dB | - | 0.100V | 0.117V | - |
| | Gain＝32dB | - | 0.180V | 0.196V | - |
| | Gain＝28dB | - | 0.380V | 0.396V | - |
| | Gain＝20dB | - | 0.780V | 0.803V | - |
| THD+N* | | $V_{DD}$=24V, $R_L$=4Ω, Pout=10W | - | 0.08% | - |
| | | $V_{DD}$=24V, $R_L$=8Ω, Pout=5W | - | 0.08% | - |
| Frequency Range | | - | 20Hz-20KHz（±3dB） | | |
| Efficiency | | $V_{DD}$=24V, $R_L$=4Ω, $P_{out}$=16W | - | 85% | - |
| | | $V_{DD}$=24V, $R_L$=8Ω, $P_{out}$=8W | - | 92% | - |
| Output Power | THD+N<1% | $V_{DD}$=24V, $R_L$=4Ω, f=1000Hz | - | 16W | - |
| | | $V_{DD}$=24V, $R_L$=8Ω, f=1000Hz | - | 8W | - |
| | THD+N<10% | $V_{DD}$=24V, $R_L$=4Ω, f=1000Hz | - | 20W | - |
| | | $V_{DD}$=24V, $R_L$=8Ω, f=1000Hz | - | 10W | - |
| Input Impedance | | - | - | 60K | - |
| Minimum Load | | - | 3.2Ω | - | - |
| SD, MUTE* | High-level input voltage | - | 2V | - | - |
| | Low-level | - | - | - | 0.8V |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Input voltage | | | | | | |
| Channel Separation* | | - | | | -50dB | -60dB | - |
| Power Gain* | SW1 | - | K1 | K2 | - | - | - |
| | Weak | - | ON | ON | 18 dB | 20 dB | 22 dB |
| | Low | - | OFF | ON | 24 dB | 26 dB | 28 dB |
| | Medium | - | ON | OFF | 30 dB | 32 dB | 34 dB |
| | High | - | OFF | OFF | 34 dB | 36 dB | 38 dB |
| Operating Temperature | | - | | | 0℃ | 20℃ | 50℃ |
| Storage Temperature | | - | | | -20℃ | 20℃ | 105℃ |
| Thermal Shutdown* | | - | | | - | 150℃ | - |

**Note:** *The chip specifications from TI's TPA3123 Data Sheet.

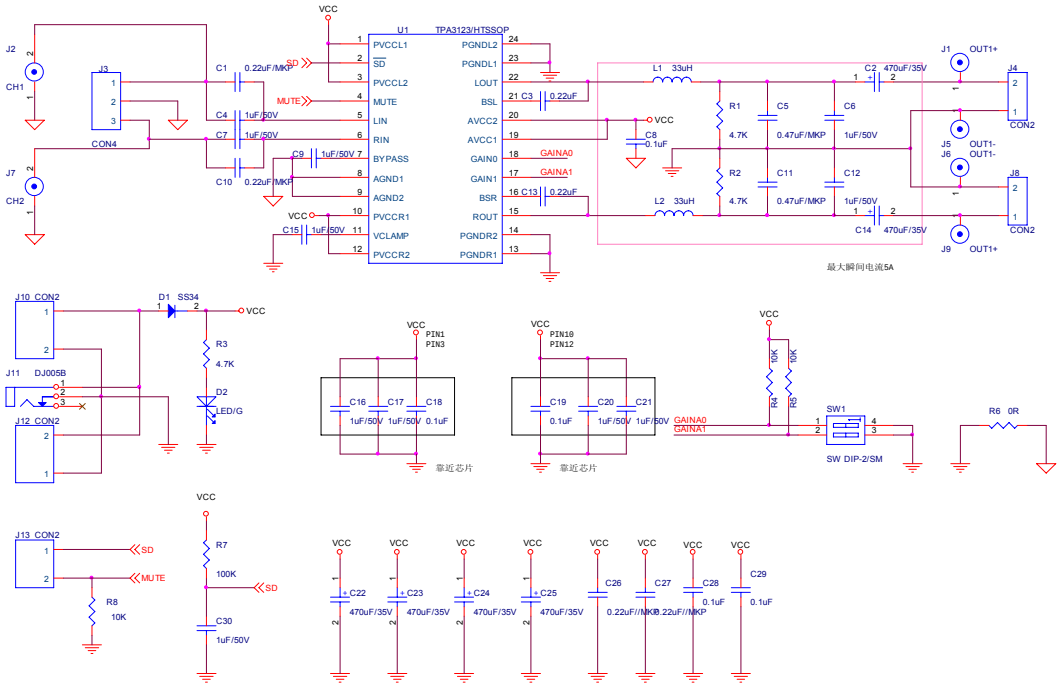
# Chapter 4. Mechanical Drawing

**FIGURE 4-1 MECHANICAL DRAWING**



# Chapter 5. Appendix

**FIGURE 5-1 SCHEMATIC**




**Note:** The above schematic is used for reference only. There might be a tiny difference in production batch.

# Chapter 6. Contact Us

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