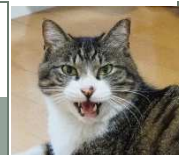


Tonochi's Audio Room - Supplemental Info



Review of Power Amp Kit ACA V1.6

2020/10/17

Review of Power Amplifier Kit diyAudio ACA (Amp Camp Amp) V1.6

Tonochi, who has a-half-century experience in DIY audio, bought and built an audio kit for the first time in his life. The kit is popular among audiophiles around the world. Tonochi evaluated it in his own way.

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Overview

I bought a power amplifier kit, diyAudio ACA V1.6, in August, 2018, and built it in October that year. It's been two years since then, I finished the evaluation at last. I know it's too late, but I dare write this report.

I bought two units of this kit. They are of the same specification: with the power switch and color of black. I built them simultaneously.

ACA V1.6 has been applauded by the most of the users. They rated it five-star. On the contrary, my evaluation is a little harsh (three-star). I'm writing this review because I should show the grounds of that harsh rating.

Introduction of diyAudio ACA V1.6

About diyAudio

It is an online forum for audiophiles who enjoy DIY audio. Audiophiles all over the world participate and share information on the forum.

I joined the forum in October, 2014. But I don't access it often. I accessed it only when I need tips to solve a big issue.

Along with the forum, an online store, diyAudio Store, is in business. I bought ACA V1.6 there.

(Note that the version is V1.8 as off August, 2020)

URL of diyAudio:

<https://www.diyaudio.com/index.php>

URL of diyAudio Store:

<https://diyaudiostore.com/>

About ACA V1.6

The key appeal point of this amp kit is the designer, who is Nelson 'Legend' Pass. Mr. Pass is one of cofounders of Threshold Company, and designed the high-end amplifiers as an engineer of that company. He runs his own firm, PassLab, now.

Mr. Pass agrees with activities of diyAudio, and gives a lot of advices.

ACA stands for Amp Camp Amp. The Amp Camp is a camp presented by Mr. Pass, where he instructs participants in building an amp kit. It is a seminar for young generation to learn DIY audio in a relaxing atmosphere.

The Amp Camp Amp is the kit that is used in the Amp Camp. It has been improved since the first release. The ACA I bought was V1.6.

Mr. Pass seems to design ACA as a volunteer. The price is reasonable.

The table bellows shows the outline **specification of ACA**. It's so unspectacular that Japanese audiophiles may not be interested.

Output stage	FET class-A push-pull
Output power	8W + 8W (8 ohm)
Distortion ratio (THD)	0.7%
Frequency range	10Hz ~ 20kHz (+/-0.1dB)
Damping factor	10

I bought ACA in May, 2018. The price was US\$317. I bought 2 units. The total was US\$634. The shipping was US\$146.99. Other than those, I paid 1,800 JPY of tariff. The total payment was about 89,000 JPY.

For the details of ACA, see the webpage bellow:

<https://diyaudiostore.com/collections/frontpage/products/amp-camp-amp-kit?variant=7072933085218>

Reasons to Buy ACA V1.6

I bought ACA for two reasons:

- (1) I wanted to evaluate the amplifier designed by the 'legend' thoroughly.
- (2) I expected that ACA was suitable for the tweeter/squawker amp in Gaudi II, since it was low output power, class-A amplifier. For this reason, I bought 2 units.

Review

Tonochi reviews ACA V1.6 in his way.

Easiness to build

The sales message said that even a beginner could build ACA in half a day. I didn't anticipate I would struggle to build it. However, it took me 12 days! I built two units and spent four to five hours a day for this. If I had built only one unit and spent more time a day, I could've shortened the schedule, but it's impossible for me to build it in half a day.

Others' user reviews don't mention difficulty in building ACA. So, they might have built their ACA in half a day actually. Hmm... I knew I'm clumsy and not good at mechanism, and I re-realized it once again (though I have half-century experience in DIY audio...).

There are four reasons why I had a time:

- (1) There are some misleading parts in the build manual
- (2) The BOM isn't provided and reference designators aren't given to the mechanical parts
- (3) Some parts are of poor quality
- (4) The schematic of the whole circuit isn't provided

Problems of Assembly Manual

The title of the manual is “Amp Camp Amp V1.6 Build Guide.” This manual is one of the appeal points of this kit. It explains how to build the kit on step-by-step basis. There are 57 steps in total. More than 100 photos are used to make the manual more comprehensible.

However, there some misleading parts in this manual which confused me. It might have been easier for me if I had referred to the schematic instead of the manual.

The problems are:

- (1) Photos are used instead of illustrations

Unlike illustrations, photos aren't good to illustrate which small parts like screws and washers are to be attached to where. It is not efficient to work while checking parts with the photos.

- (2) Some photos don't show the real amplifier in the step

In that case, the amplifier in the picture has parts on it that are not supposed to be attached, and doesn't have parts that has been fixed in either of the previous steps.

- (3) The lengths of the wires are not designated

In the “wiring diagram,” the thickness (AWG22 or AWG18) and the colors are shown, but the length are not. It is needed to measure up the paths of each wire to determine the lengths. It is rather troublesome.

If I were the writer of the manual, how would I do?

Here is one example, which I wrote for my original amplifier. See the PDF (MV-217_Assy.pdf) bellow.

https://nobody-audio.com/English/img/MV-217_Assy4.pdf

I wrote the manual for my original amplifier MV-217 X'tal. For information on this amp, see the webpage bellow.

https://nobody-audio.com/English/mv-217_en.html

Lack of BOM

This kit doesn't include BOM. It would increase productivity.

The BOM includes the name, spec, quantity and reference designator of each part. If this information is used in the build manual, it is so helpful for the user.

Problems of the Parts

The most parts of ACA V1.6 are of good quality, but some of them are problematic. Extra efforts were needed due to the defective parts.

- (1) The screws used to fix the heatsink rails to the front panel cannot be tightened

The screws are commonly-used dome head screws. But a special screwdriver is needed to tighten them, because the handle of the screwdriver is blocked by some parts of the amp and the screwdriver can't be vertical against the front panel. It is okay if the screws should be loosely driven, but they can't be tightened firmly.

I replaced the dome head screws with socket head screws.

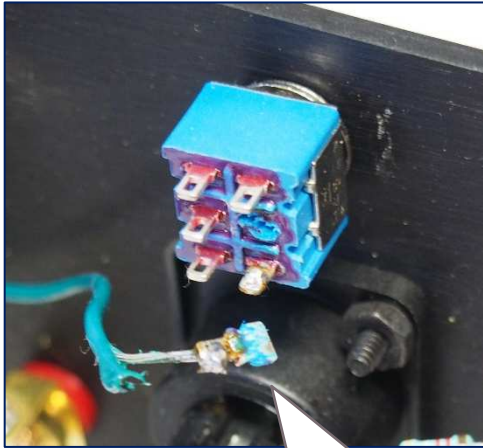


(2) The low heat tolerance of the switches, connectors and wires

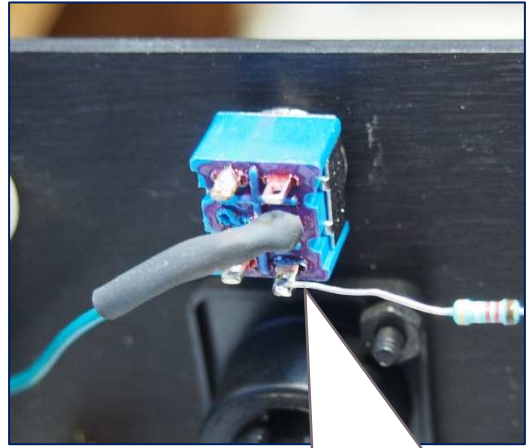
The heat tolerance of the switches and the connectors are so low that their insulators melt when a soldering iron touches them for only a few seconds. They must be the cheapest ones. If it would be possible to lower the temperature of the soldering iron, this problem could be solved. But it's not allowed because I use silver solder. The temperature should be 400 deg C or higher.

The switch on the rear panel is 2-pole type. I destroyed the one of the poles, but I managed to fix the trouble by using the other pole.

The heat tolerance of the wires is also so low that I needed extra carefulness.



The terminal removed because of the melting insulator

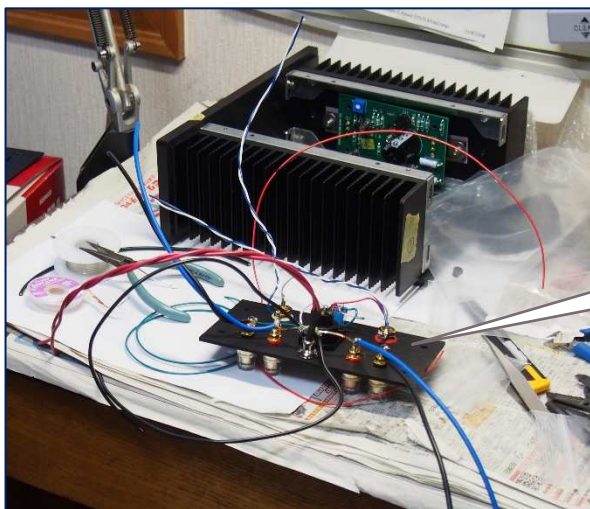


I rotated the switch by 180 deg, and used the remaining pole

(3) The lengths of the wires may be too short

The manual doesn't designate the lengths of each wire. I cut the wires for the parts on the rear panel longer than actually needed, and soldered them to the parts. When I soldered the wires to the PCBs and the switch on the front panel, I cut the wires to the proper lengths. I thought the red wire in the kit is not long enough. I didn't use it. Instead, I used an OFC wire I bought at the nearby DIY shop.

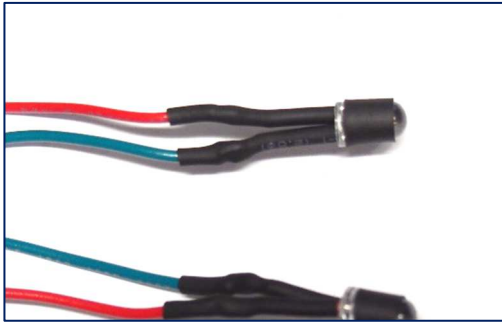
Maybe, my way of assembly is not good, but if the wires in the kit had been a little longer or the lengths had been designated in the manual, I didn't have to go buy the wire.



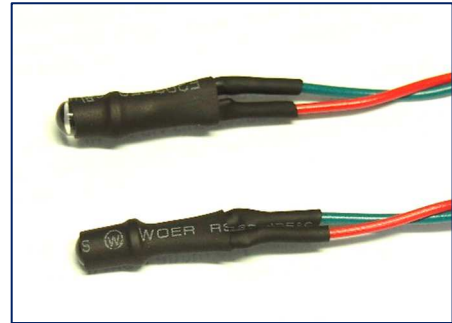
Wire for the rear panel cut a little longer

(4) Difficulty to mount the LEDs

I couldn't insert the LEDs into the holes in the front panel. I fixed the LEDs with hot melt adhesive.



I followed the manual at first



I used longer shrink tube



The LED fixed with hot melt adhesive



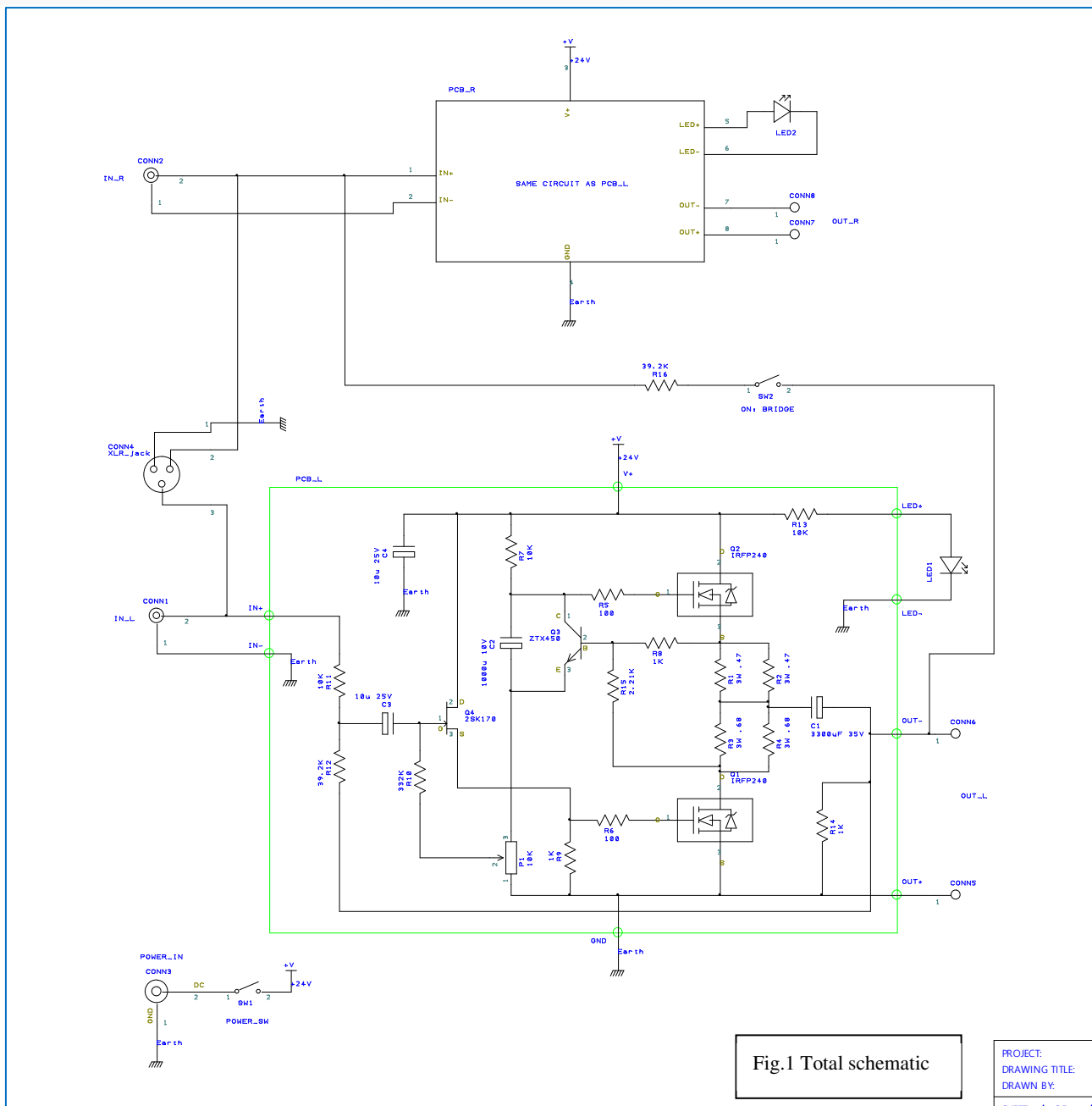
The tool (hot melt gun)

Problem of Schematic

The schematic is the most important material to understand amplifier design. Not only the schematic of the PCB but the schematic of the entire amplifier is necessary. It is very useful when the amp is checked.

By the way, according to the schematic of the PCB, the LED should be mounted on the PCB. Actually, the LED is mounted on the front panel. I think this mix-up is caused by the lack of the schematic of the whole amplifier.

I created the total schematic (fig.1) by myself. I referred to it when I soldered the wires.



Electronical Characteristics (Measurements)

The measured data show that the both channels have the same characteristics. I'll show the data of the left channel basically.

My method of the measurement (Tonochi Method) is a bit different from the industrial standard.

Please see the web page below for details.

https://nobody-audio.com/English/posts/method_en2.html

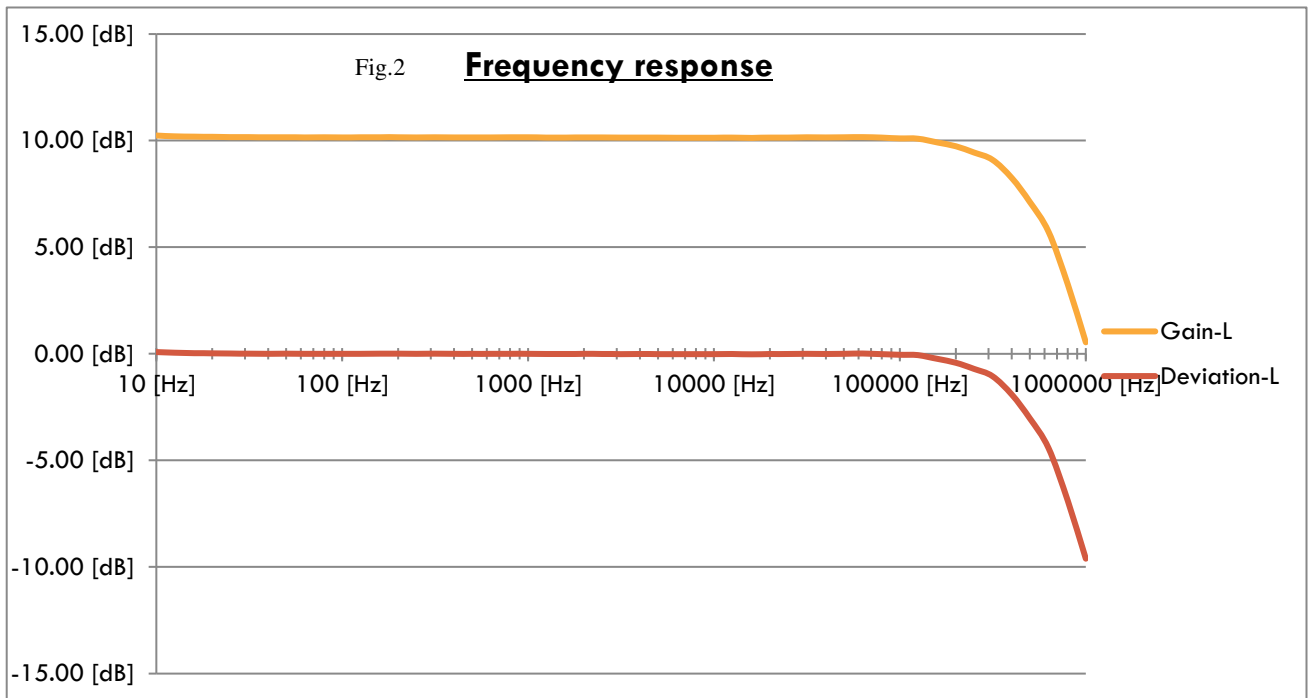
Frequency Response

The gain is about 10dB.

The curve is flat. No peaks are observed.

I didn't measure the frequency response at the frequencies of 10Hz and lower. I anticipate the low end is 1Hz or lower. The high end (-1dB) is 315kHz.

The fig.2 shows the frequency response.



Residual Noise

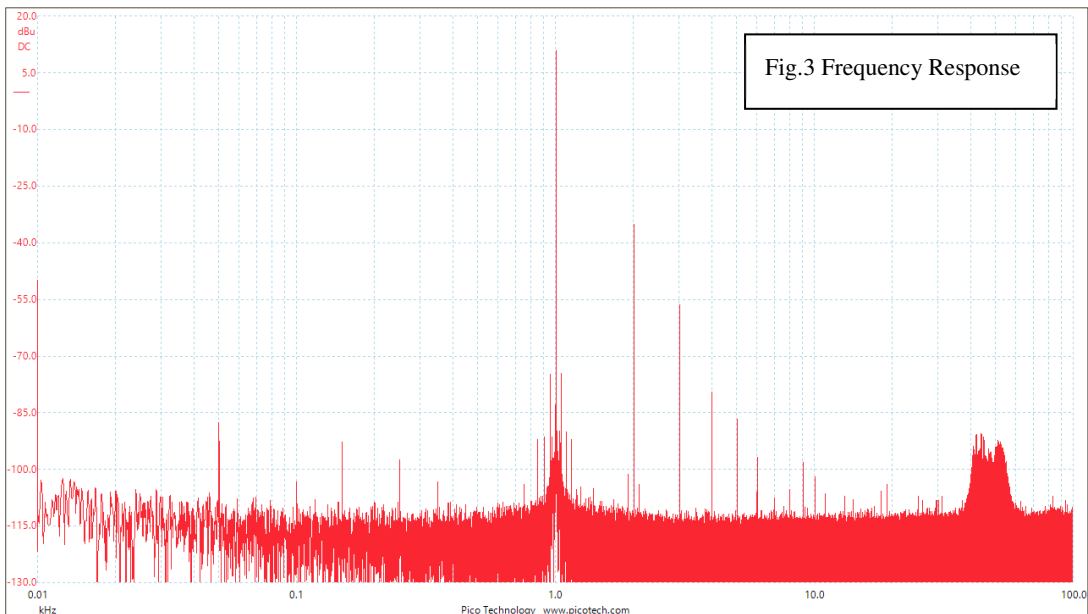
I couldn't measure accurate data due to the limitation of my instrument. The result is about 300uV (0.01uW). I think it is good.

FFT Analysis

Fig.3 shows the frequency spectrum. The signal is sine wave of 1kHz.

There are a lot of higher harmonics.

THD = 0.538%, IMD = 0.498%, SNR = 65dB.



Crosstalk

Large crosstalk occurs. It's about -60dB.

It is larger at 20kHz: -50dB.

I saw such large crosstalk for the first time.

I suppose this large crosstalk is caused by the long DC power supply wires. If the wires are shorter, the crosstalk could be less.

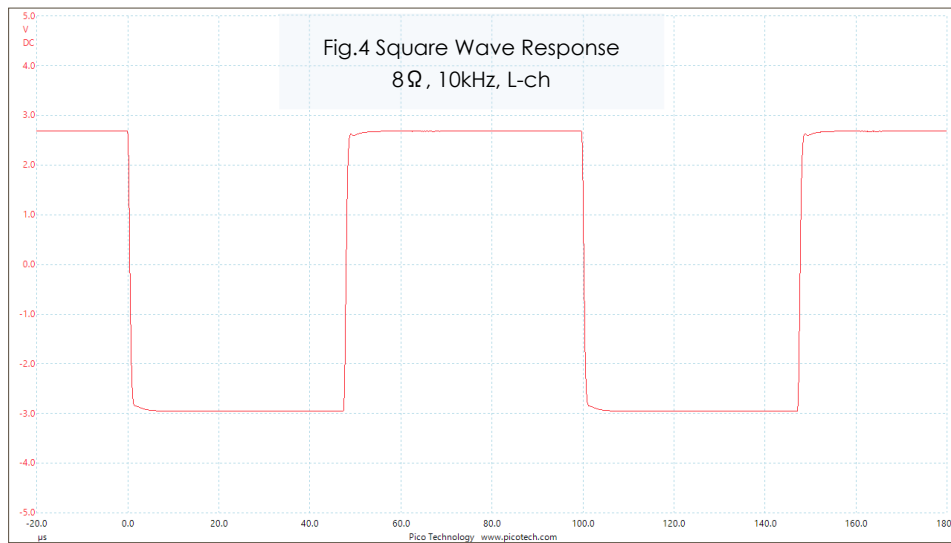
Direction	Frequency	E ₁	E ₂	crosstalk
L=>R	20 [Hz]	7.21 [V]	6240 [uV]	-61.25 [dB]
	1000 [Hz]	7.28 [V]	6467 [uV]	-61.03 [dB]
	20000 [Hz]	7.22 [V]	20150 [uV]	-51.08 [dB]
R=>L	20 [Hz]	7.33 [V]	7744 [uV]	-59.53 [dB]
	1000 [Hz]	7.42 [V]	7985 [uV]	-59.36 [dB]
	20000 [Hz]	7.35 [V]	30260 [uV]	-47.71 [dB]

Square Wave Response

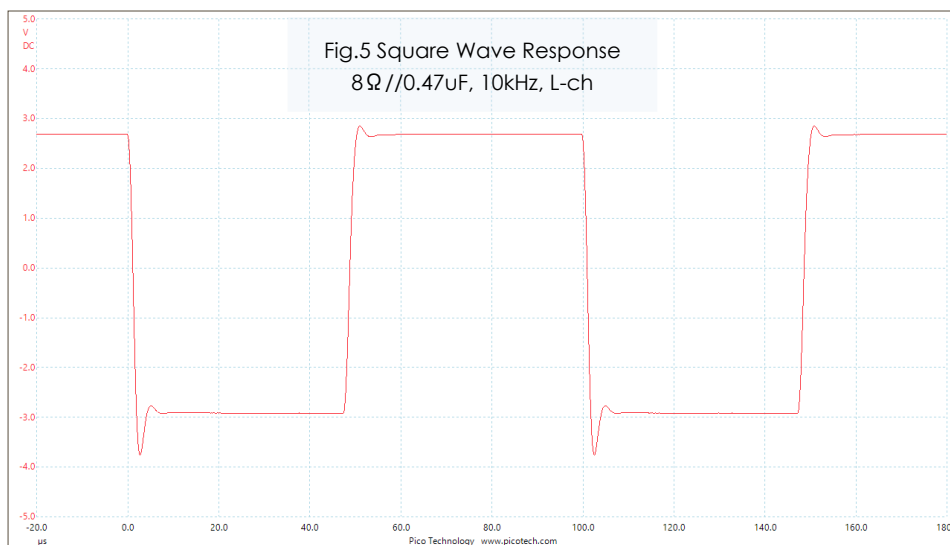
I observed square wave response at 100Hz, 1kHz and 10kHz.

Two types of load are used: pure 8-ohm resistor, and 8 ohm and 0.47uF connected in parallel.

All the waveforms are perfect. The following figures (fig.4 and Fig.5) are waveforms at 10kHz.



With the capacitor of 0.47uF, small undershoot occurs, but it doesn't matter.



Output Power

The output power is 6.5W. It's a little smaller than the catalogue spec. The load is 8ohm//0.47uF.

Frequency	Left channel	Right channel
20Hz	6.0W	0W
	0W	6.2W
	6.3W	6.4W
1kHz	6.6W	0W
	0W	6.6W
	6.7W	6.8W
20kHz	6.4W	0W
	0W	6.8W
	6.7W	6.8W

It's interesting that the output power becomes slightly larger when the both channels are in the maximum power than when the single channel is in the max.

Damping Factor

The damping factor is around 7 and not depending on frequency.

Frequency	Damping factor
20Hz	7.27
1kHz	6.73
20kHz	6.47

Power Consumption

The power consumption is maximum when the output is zero (input is zero). It's interesting. The consumption of 76W is too large for a small output amplifier. That's the class-A amp!

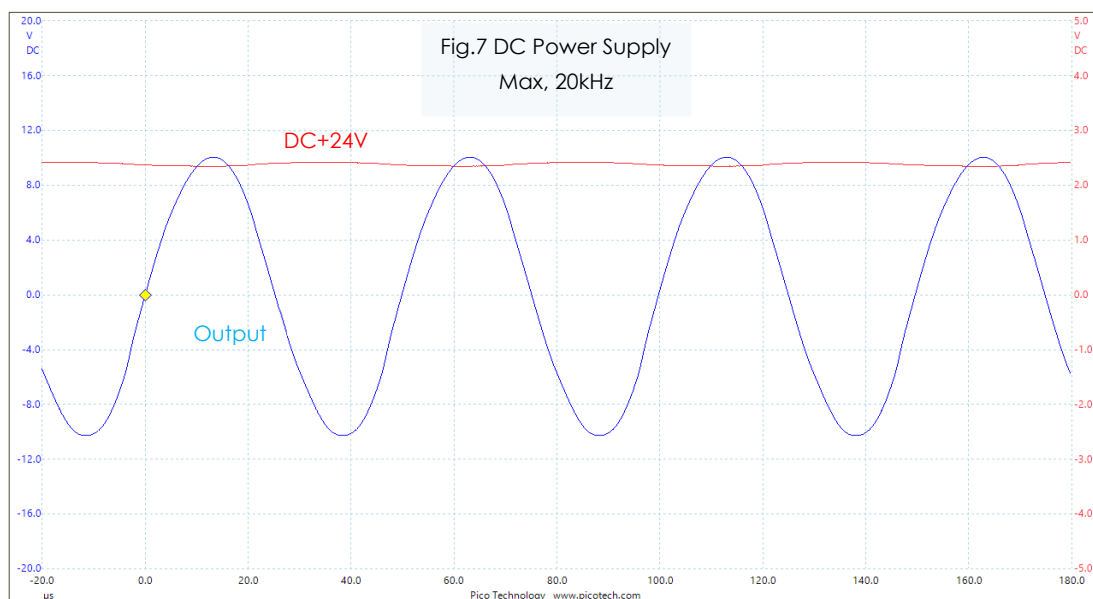
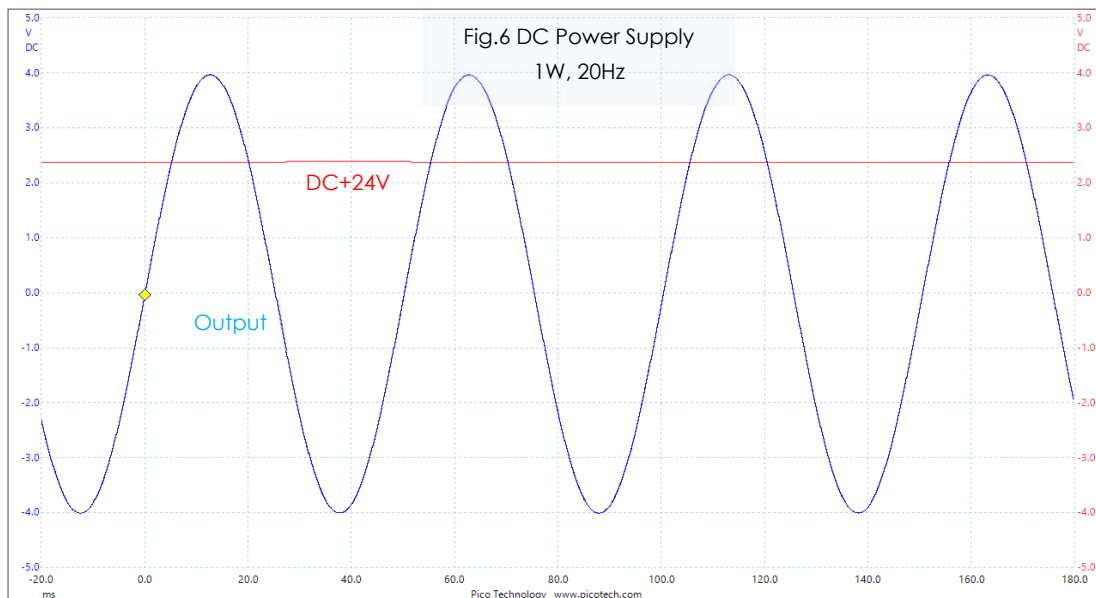
Condition	Consumption
Power off	0W
Output = 0W	76W
Output = 1W	74W
Output = max	66W

Regulation of DC Power Supply

They say a class-A amp doesn't require a high-performance power supply, but the DC power lines of ACA are so long that I was interested in the regulation of the DC power voltages. I made measurements at different output power.

Frequency	Output	Ave. voltage	Max voltage	Min voltage	Fluctuation	Regulation
20Hz	0W	23.83V	23.83V	23.83V	0.00V	0.00%
	1W	23.83V	23.83V	23.83V	0.00V	0.00%
	Max (6.5W)	23.85V	23.85V	23.84V	0.01V	0.08%
1kHz	0W	23.83V	23.83V	23.83V	0.00V	0.00%
	1W	23.84V	23.84V	23.84V	0.00V	0.04%
	Max (6.5W)	23.85V	23.85V	23.85V	0.00V	0.08%
20kHz	0W	23.83V	23.83V	23.83V	0.00V	0.00%
	1W	23.83V	23.83V	23.83V	0.00V	0.00%
	Max (6.5W)	23.84V	23.84V	23.84V	0.00V	0.04%

As I had expected, the results are perfect. Fig.6 and Fig.7 are the waveforms of the DC power supply line and the output.



Sound Quality

Sound quality of ACA is very good.

As the square wave response shows, its sound is stable and crisp and clear.

By the way, this amp doesn't have two essential features.

One is volume control, and the other is muting circuit that suppresses transition noises at power-on/-off.

In a way, this circuit design can be called a cunning design because an amp circuit without these two features will hardly impair SQ regardless of circuit types (class-A, class-AB, class-D, FET, tube,,).

The muting circuit has greater influence on SQ than the amp circuit. Especially, relay (if it's used) is influential.

The volume control is influential too. It must be equipped somewhere in the audio system. The component that has the volume control (usually a preamplifier) is more influential on SQ than ACA.

Noise

No residual noise is heard.

However, it's natural because no well-designed power amplifier offers audible residual noise.

As for SNR, there is no problem.

The problem is the noise at power-on/-off transitions.

The power-on noise comes shortly after the power-on. The amp oscillates for a short period of time, and a weird sound like a bottom burp comes from the loudspeaker. It is acceptable because the volume is small.

The power-off noise is so intense that it makes me worry about a possible damage of the loudspeaker.

This power-off noise can be reduced by turning the amp off with a switch on the AC side (a switch of a power strip). I do so. I should've have chosen the ACA without the power switch.

Listening Trial

I did the listening trail of ACA with Kinglet, my audio subsystem in my study/lab room. The loudspeaker has a single LS unit (Fostex FF105WK). This system is suitable for a listening trial of a power amplifier.

The outline of Kinglet is as follows:

- Player: HP Pavilion 15-Cu1000 (PC) + KORG AudioGate 4 (PC app) + KORG DS-DAC-10 (USB DAC)
- Preamplifier: NOBODY MV-217 X'tal (my DIY amp)
- Loudspeaker: NOBODY SS-312A Study (my DIY loudspeaker)
- Room: The floor space is as small as 10m²
- Room acoustics: Live

For further details, please see the following web page:

https://nobody-audio.com/English/posts/topics_en2.html

I listened to many of my favorite records to evaluate SQ. I spent as long as three months for the audition to weaken preconceptions as much as possible (preconceptions have great influence immediately after building an audio device). Most of my favorite records are LP. I recorded them in DSD 5.6M format by using Gaudi. I replayed the DSD files. In addition, I used some hi-res music files. Among them, 2xHD *Audio Speaker Set-Up* (DSD5.6M) was so useful since it contains sounds of various kinds of musical instruments.

Comparison with Other Power Amplifiers

I compared ACA with my DIY amp (MA-215 Arabesque) and Flying Mole DAD-M100pro, also using Kinglet and the same music source.

MA-215 is a chip amp using a power op amp LM3886. LM3886 is a BJT IC. Its output stage is class-AB push-pull.

For details, see the webpage bellow:

https://nobody-audio.com/English/ma-215_en.html

DAD-M100pro is a class-D mono amp. Its output power is 100W (into 8 ohm). I bought it in 2005. It seems that it's still in production and available.

The URL of Flying Mole's site is as follows:

<https://www.flyingmole.co.jp/jp/index.html>

I carefully adjusted the volume control of the preamp so that the total gain of the system remained the same for either of the power amps. This is necessary because the volume greatly affect SQ.

The listening position is important too. A shift of the listening position by 10cm affects SQ more than replacement of the power amp. I was careful to keep the listening position.

I thoroughly auditioned one of the power amps for two to three days. Then I auditioned the other amp in the same manner, and so on. I took me one month for the whole audition. I focused on the music rather than SQ of the amps. It's my way to evaluate an audio device.

The following table shows the result. I placed them in the order, though it was so difficult task. All the three amps were very good in SQ. As always, it's so difficult to distinguish power amps in comparison of SQ that the ranking changed day by day. The final ranking is shown in the table.

Power amp	Ranking	Impression
ACA V1.6	3	Crisp and clear sound. The resolution is slightly lower than the other two amps. It was difficult to tell hi-res from CD quality.
MA-215	2	Clear and transparent sound. The sound of cymbal sometimes sounded a bit unnaturally.
DAD-M100pro	1	Hi-res sound. Good in stereo imaging. Vocals sounded realistic. No apparent shortcoming.

User-friendliness

ACA V1.6 is not user-friendly.

It doesn't have volume control. So, you need preamplifier or a volume unit to use ACA. The system isn't simple. If you use a PC or a smartphone as the music player, you can use the volume control of the player. But it's not a good way to build high quality system. In case that the player's volume control is used, a cheaper amp or a powered speaker for PC suits the system better than ACA.

It's a little bothersome to find a space for the separate AC/DC convertor, when ACA is placed on a small rack.

ACA is a class-A amp, and gives out a lot of heat. It must be placed at a well-ventilated spot.

The power switch is located on the front panel. It is likely for the user to touch it accidentally and cause unwanted power-off. The power-off causes a big noise. As mentioned above, you should choose the model without the power switch and turn it on/off with a switch of a power strip.

The stereo/mono switch is mounted on the rear panel. It is a toggle switch, and can be toggled by an unintended finger touch. It should be a slide switch to prevent an accidental switching.

Looks

The looks of ACA is very good.

I was pleasantly surprised by the quality of the enclosure, when I received it. The parts are of high quality for the price: 10mm-thick aluminum front panel, large heatsinks with wave-shaped fins, aluminum top and bottom panels, etc. It looks so good after assembled too. I think this enclosure itself is a good buy.

One thing, the rear panel doesn't have letterings. If it does, the enclosure is perfect.

I made stickers by using my PC and printer, and affixed them on the rear panel.



Summing-up

When I received the parts of ACA, I was excited expecting the amp would be a nice one. But I got tired by spending much time to build it. That spoiled my excitement.

The sound quality (SQ) of ACA is very good, though, I concluded it's not superior to other well-designed amps.

I wonder how I use ACA, since it's not user-friendly.

I am planning to use it in my small audio system (Kinglet). I haven't come up with a good idea about other uses. At first, I expected it could be used for the tweeters and squawkers in the multi-amplifier system (Gaudi II), but I gave it up because of the big noise at the power-off.

I built two units of ACA, but one of them is of no use. I displayed it in the living room for an ornament.

ACA is a good amp kit for those who enjoy assembly work. It looks so good, and SQ is so good for a DIY amp. But it's not so good for those who don't like assembly work, yet pursue high SQ like me.

My total rating is three stars: ★★☆☆☆

SQ: ★★★★★

Looks: ★★★★★

User-friendliness: ★★☆☆☆

Easiness to build: ★★☆☆☆

I learned two things from ACA:

- (1) Commercially available AC/DC converters fit well with an audio amp.
- (2) It's unnecessary to stick to "class-A" and "FET". Class-AB and BJT have enough performance for high SQ. The class-AB consumes less power and give out less heat.

I propose some **improvements** about ACA, though they may increase the cost:

- (1) Add a built-in volume control.
- (2) Contain the AC/DC convertor in the enclosure, and place the power switch on the AC line side.
- (3) Replace the AC/DC convertor with +/-12V type, and remove the output capacitor.
- (4) Change the class from A to AB in order to reduce heat emission.
- (5) Replace the heatsinks with resonance-free type.
- (6) Replace the cheap switches with quality switches.

[END OF DOCUMENT]

NOBODY Audio

Tonochi's Audio Room – Supplemental Info