

Stories about N8ii Development

From N8 to N8ii, it takes us about 4 years.

In fact, according to the original plan, the launch of N8ii should have been Q3 2021 and then Q4, but for various reasons, it has been delayed until now. One of the objective factors is that the N8ii uses a large number of discrete components for audio, and because of the difficulty for source (including delivery time, unavailability, cost, and many other factors), we have been unable to finalize the BOM, and some of the circuits have been redesigned due to changes in these materials.

Just because of the extended time and uncertainty, we've had two blogs on Social Media. Now let's get right to the topic of the N8ii so that interested enthusiasts can see if the N8ii's design definition meets your expectations. In the article it cannot be too long and we will only focus on the audio portion of the design.

1. Dual matched KORG Nutube 6P1s have been used. New physical structure, damping design and circuit architecture have been applied to realize a true fully balanced tube tone circuit.
2. Dual flagship DAC chips BD34301EKV from Rohm have been used. Furthermore the DACs always work in MONO mode.
3. Dual Operation Modes can be chosen: Class A and Class AB. N8ii takes all discrete components to form a four-channel power amplification circuit. Customers can choose Class A or Class AB through changing the bias current.
4. Dual Power Output Modes can be chosen: P and P+ Mode. It is realized by setting different operating voltage of the Headphone Amplification circuit. (Class A and P+ modes cannot be used simultaneously).
5. JRC NJW1195A four-channel analog precision volume control chip is used for the volume control circuit.
6. Independent LO Circuits for Single-ended and Balanced.

Reading above six points, do you have a familiar feeling? Because either Discrete component audio circuits or Tube/Solid-State Dual Timbre, whether Class A Class AB or P and P+ have appeared in Cayin's previous products. Comparing with former Cayin DAP N8ii is different and lacks Innovation?

After the release of N8 in 2018, Cayin released three portable products. First, N6ii in 2019, for which the E01 and E02 audio motherboards use discrete component audio circuitry and achieve

Class A and Class AB operation modes. Second, N3Pro in 2020, which also uses the American Raytheon CK6418 to form a Tube/Transistor Dual Timbre. Third, C9 announced in early 2021, which is a combination of discrete component audio circuitry, Class A Class AB, dual KORGNutube 6P1 Tube etc.

N8ii is a combination of the above-mentioned technology. We also absorbed feedback from customers in the market over the past few years. Bring together the real mature technologies that users need in one product. Although there are not many new concepts in terms of user perception, the challenge of applying so many technologies to the same product and meeting various factors such as weight, size, control, and large touch screen is still very difficult.

Let's start with the implementation of N8ii Tube Circuit. N8ii takes Android system. In order to let the customers operate easily and also get a relatively large PCB area, the screen we are using is a 5-inch OLED (1280 * 720), which also means that the way of tube Installation we take for N8 and N3Pro cannot not be applied for N8ii. If we install the tubes to the back of the player, it will significantly compress the effective area for the battery and does not meet the needs of battery requirement. After several rounds of experiments, Cayin's engineers dug out a frame structure from the entire aluminum block where we can put the Tube Module vertically. It is located on the left side of the case. In such way it made a very effective physical division between the electronics, battery, display, PCBA and Tube Module. This implementation gives the N8ii a more technical appearance while not affecting the user's operation at all, and it also improves the microphone effect to the greatest extent. Of course there is a disadvantage. Because of the height of Nutube 6P1 itself and also the need to leave a physical gap for vibration-absorption it makes the N8ii 25mm thick, but the overall grip and operation of the device is still relatively balanced.



N8ii Tube Installation Picture

N8ii uses the same tubes as N8 and C9, but there are differences in the circuitry and their sound performance. Customers who own both N8 and C9 will have a more direct experience for the statement. From the time Cayin got the Nutube 6P1, we have not stopped experimenting with the development and application of this tube, and the timbre it produces varies greatly when placed in different positions in the circuit architecture. In development of N8ii Tube Application we have taken our experience on N8 and C9 development and also feedback from customers into consideration. N8ii uses a large loop negative feedback zero gain circuit. We tuned the amount of feedback on the tube circuit carefully to get a nearly transistor transparent, speed and extension while not losing the warm and mellow sound performance of the tubes.

Cayin has been engaged in development and production of Tube Amplifiers for nearly 30 years. We have an in-depth understanding of the characteristics and circuitry of various types of tubes. Although Nutube 6P1 is a new type of tube which is different from traditional Vacuum Tube, Cayin has completed no less than 30 designs on the demo board for better application of the tube. It should be noted that for some Tube Amplifier Audiophile they do not like the design of large loop depth negative feedback. It is because with such a design it will not be as rich as Traditional Tube Amplifiers in Tube Sound and lose the rhythm of Tube Amplifier, which is the reason why for N8 we do not use this circuit architecture when we work on Nutube 6P1 for the first time. However actual situation is that users of portable products is still very different from users of Traditional Tube Amplifier. Most users of portable products like a more sense of linearity, speed and transparency of the sound. C9 uses a deep negative feedback circuit design and reduces the even harmonics. As a result overall transparency of the sound is more close to the performance of transistors, which presents a different style from N8.

As for these two different designs both have their followers. How is the actual sound performance? It will need users to test and listen and make their own judgement. For designers, the most important thing to do is to stay close to the market demand and to meet requirements of customers. In N8ii, our third generation of tube design, we need to find a better balance between N8 and C9 designs to give customers our understanding on Tube Technology and share with them about our ideas through product designs.

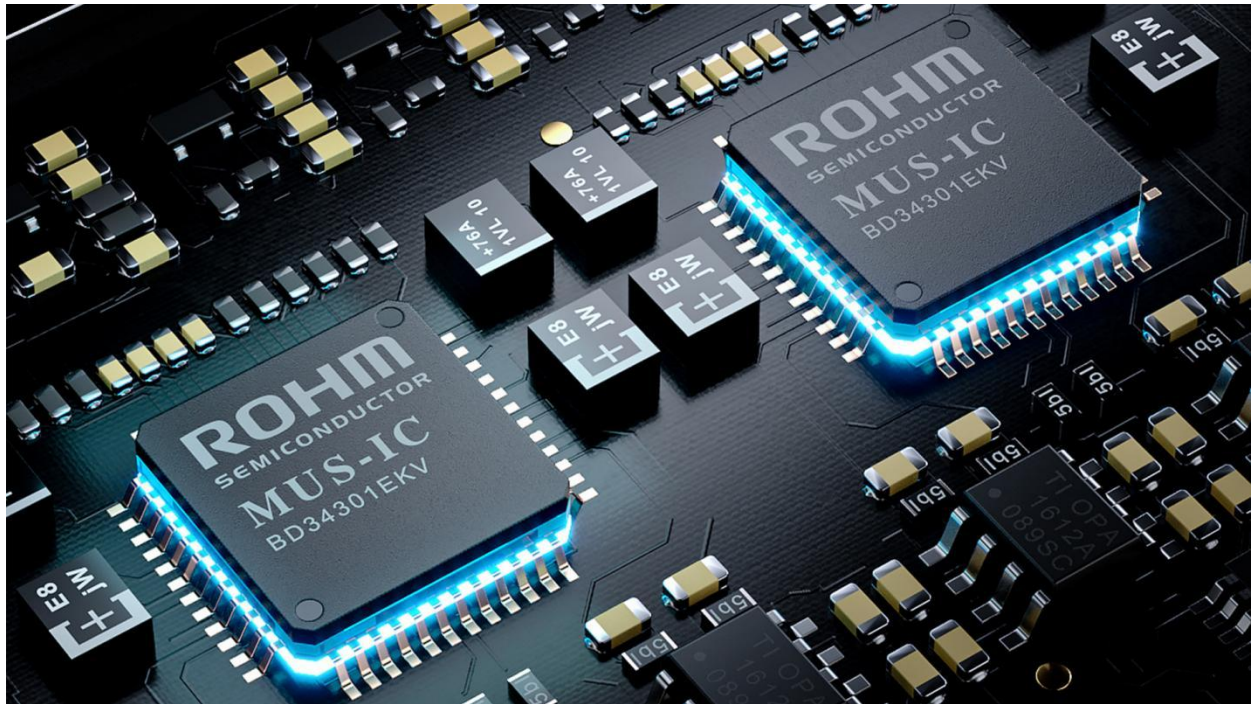
Besides, when Nutube 6P1 is powered on there is a DC signal output. Although the amplitude is low for the audio system the DC signal entering into the back-end amplification and into the load is fatal. Therefore for N8 and C9 we have set a 5-second delay before switching on the output of the audio signal. N8ii is no exception to retain the same design. A 5-second delay is also to make sure tubes can have a basic warm-up and stable output working conditions.



Above picture is showing you how it looks when Tubes are working in N8ii.

Next to Tube Design most customers might be interested in the DAC Chips used in N8ii. N8ii was initially developed on basis of AK4499 chip. However, for well-known reasons, we had to stop and switch to a new solution. It is Rohm BD34301EKV, a Current Output DAC Chip we turn to. We had a long-term relationship with Rohm factory and Cayin was the first to get the prototype and demo of this chip from Rohm. Our hardware engineer spent nearly four months making six engineering boards, capturing a large amount of its data and repeatedly testing the converted analog signal data. We have been repeatedly comparing and tuning with the original demo. Finally we completed the tune of BD34301EKV DAC Chip. In our previous blogs, there are some friends who said they have not heard of this chip before. It is true that it is a new chip. It will take fairly long period of time for customers to know the Chip. However, we believe that in this era of "lack of Chip", with more and more products using the Chip BD34301EKV DAC will slowly become more widely known because no matter from the specifications or from the performance the BD34301EKV DAC has very excellent characteristics.

We will not be more specific about the DAC. As the core part of audio products, the process lies more in the overall circuit design, including the processing of digital signal shaping, etc. These things are boring to talk about, but it is the most important part of the design. As from the point of view of customers, with the next DAC what kind of sound you can bring are even more interested to them.



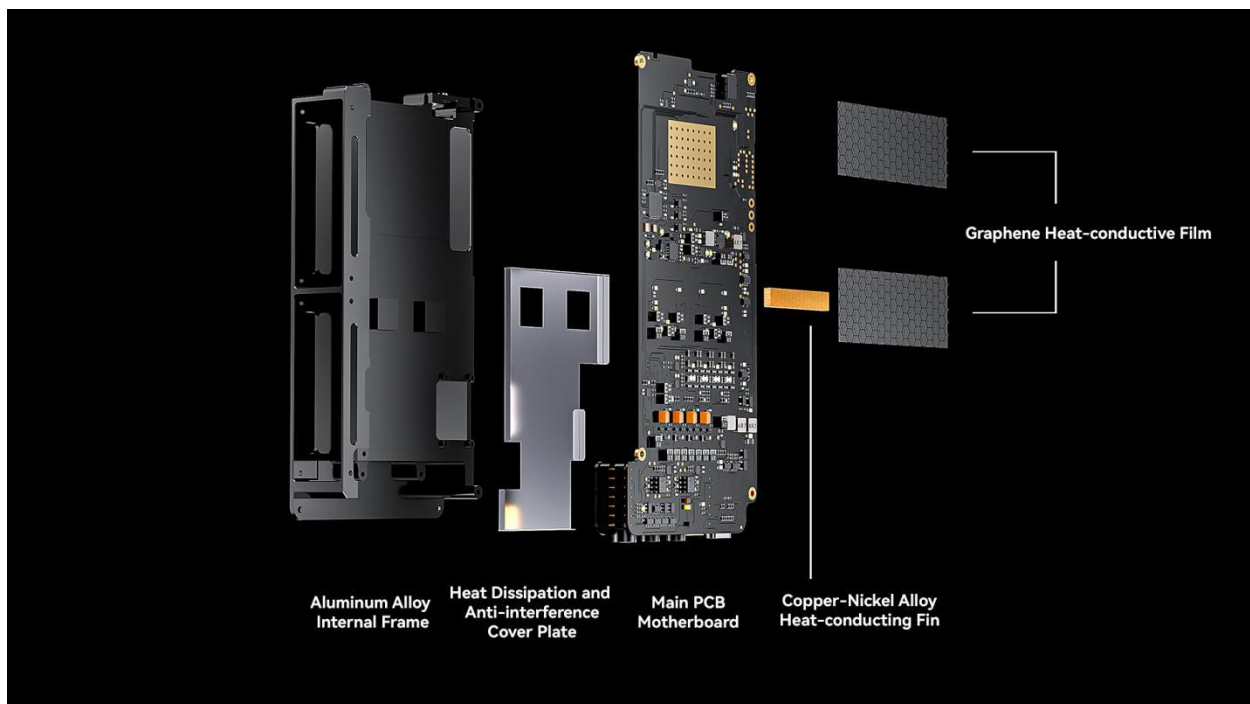
N8ii uses a 3.8V 10,000mAh high-capacity lithium-ion polymer battery with low internal resistance. Under different Operation and Output Modes its longest duration is about 11h (3.5 single-ended output, class AB, transistor, P mode) and shortest is about 8h (4.4 balanced output, tube, P+ mode, class AB). N8ii has a variety of output modes and operation modes, allowing users to make various choices and get the best listening performance according to their needs. Audio Amplification circuit of N8ii is designed with Discrete Components. With experience we have on N6ii E01, E02 and C9 development, considering on the N8ii Battery characteristics we manually pair and match the TRIODE of each stage to ensure the accuracy of the bias current setting and signal range of the triode amplification. It will help achieve sound changes by the different operate modes of Class A and Class AB. Concerning the differences between Class A and Class AB we had introduction before when we are introducing N6ii E01 and E02. Many customers like the sound of E01 very much, but at that time, based on the framework of the N6ii, there are many restrictions and the Power Output is relatively low.

We have spent a lot of efforts on N8ii structure to do good on heat dissipation. Not only because of the complex circuit construction, but also because of the low conversion efficiency and high power consumption of Class A. Sound of Class A is vivid, full and very distinctive and recognized by many audiophiles. It would be a pity if it could not be realized because of heat dissipation and other problems. Therefore, in the development process, in addition to the precise setting and tuning of the bias current, how to make the thermal conductivity faster and more uniform is also a major difficulty. N8ii case is not made of copper or stainless steel but of the more common aerospace magnesium-aluminum alloy. One of the reason is because of the low thermal conductivity of copper and stainless steel, and partly because of balanced considerations of size and weight. Size of N8ii is 147*77.5*25mm and weight is 442g.

However, it should be noted that there are some laws of physics that cannot be avoided. In P+ Mode the supply voltage of the discrete amplification circuit of N8ii will be increased in order to provide a higher power output. If Class A is turned on at the same time, the quiescent current of the discrete amplification Triode will increase dramatically, which will result in very high

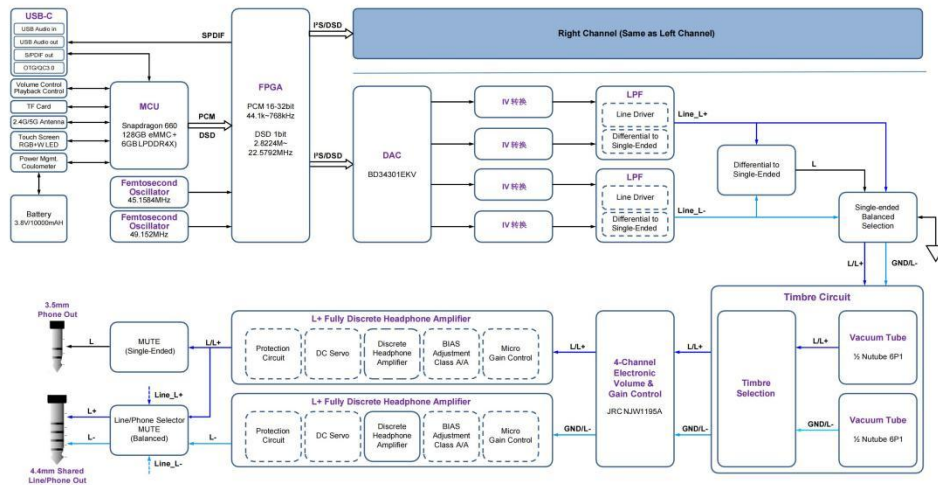
operating temperatures. The internal space of portable DAP for heat dissipation is still very limited after all. In this extreme working scenario the internal temperature will be too high and the heat dissipation cannot be ensured. Under such case the lifetime and operation state of electronic components will be quite affected. As a result in our definition and design P+ and Class A cannot be enabled at the same time for this reason. (As for desktop it is not difficult to realize the function but for Portable DAP which has size requirements it will become an extreme situation).

Without our continuous research and improvement on structural and circuit design, N8ii is able to achieve 440mW Power Output (32 ohm load) for 4.4 Balanced Output under Class A. This will help a lot to drive difficult loads much better. The regret of not full-functioning and being not powerful enough under E01 or E02 will no longer exist.

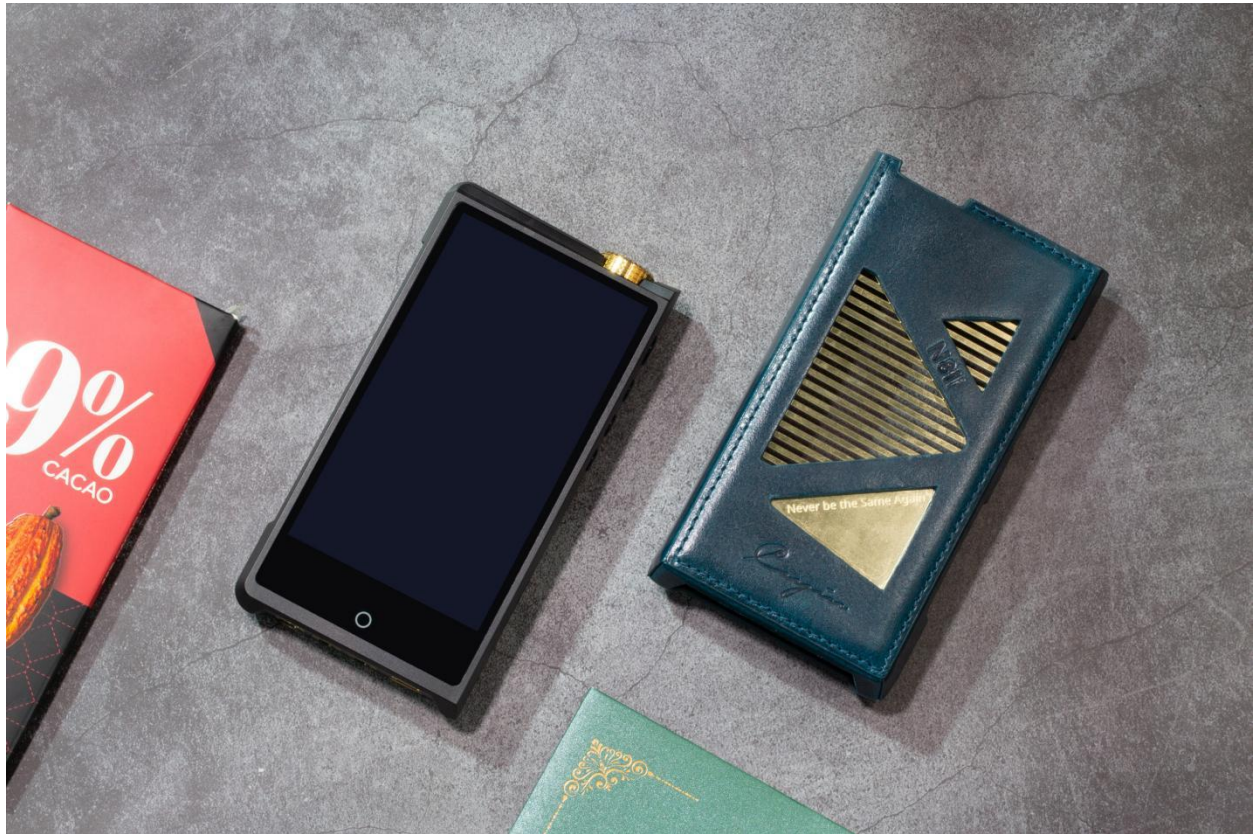


N8ii has even more design features, but the content is also rather boring and tedious. We will not repeat them here. Anyone who is interested please check the circuit architecture as in picture below. Even more details will be available through our website and Social Media.

Cayin N8ii Functional Diagram (Left Channel only) (Headphone Output)



Regarding the system and MCU, N8ii uses Qualcomm Snapdragon 660 main control, 6GB memory and 128GB Internal Storage, Android 9.0 system, and the popular HiBy OS, which are all-around improvement comparing with N8 first generation. Cayin also retains its own design features, such as the built-in ring-shaped HOME touch key with full-color LED backlight. The metal volume knob on the top is made of brass with real gold plating by five-axis CNC engraving process, and the pattern design on it comes from Cayin's young post-90s team, which is a bit of a western metaphysical color magic array. Same as N8, N8ii will come standard with a leather case made of blue water-grain leather imported from Italy.



N8ii is scheduled to be officially launched on March 4th, 2022 in China. In International markets it may be different in different markets considering on the uncertain Delivery situation. We will work together with our International agents and try to get N8ii there locally asap so that you can come to try, listen, choose and enjoy.

Last but the most important. Our International suggested retail price is USD 3499.00. Considering the different VAT etc your local Retail Price might be different. Please feel free to get contact and check with our agents locally. As for local agents please feel free to check on our website www.cayin.cn.

Cayin, Never be the Same Again.