

The Analogue Amplification System for UE10

The PWR-ICE125 power amplifiers from miniDSP used in the original amplification system are Class-D type of amplifiers with switching mode power supply. They are not heavy and very efficient. However, I was not comfortable with the 4Vpp, 500kHz switching residual component appearing at the output, so a simple LC low-pass filter was installed at the output to suppress it. For more information, please review the paper referenced below.

https://www.bodziosoftware.com.au/Hybrid%20AES_EBU_Analogue_System.pdf

The switch-mode power supply was another element I was not comfortable with. My preference is with power supply with strong current capabilities and large capacitor banks.

Recently, I came across CROWN CP 660, multichannel amplifiers and decided to examine a possibility of implementing those in my HT system. Some information about those units can be accessed via the link below.

<https://www.crownaudio.com/en/products/cp660#support>

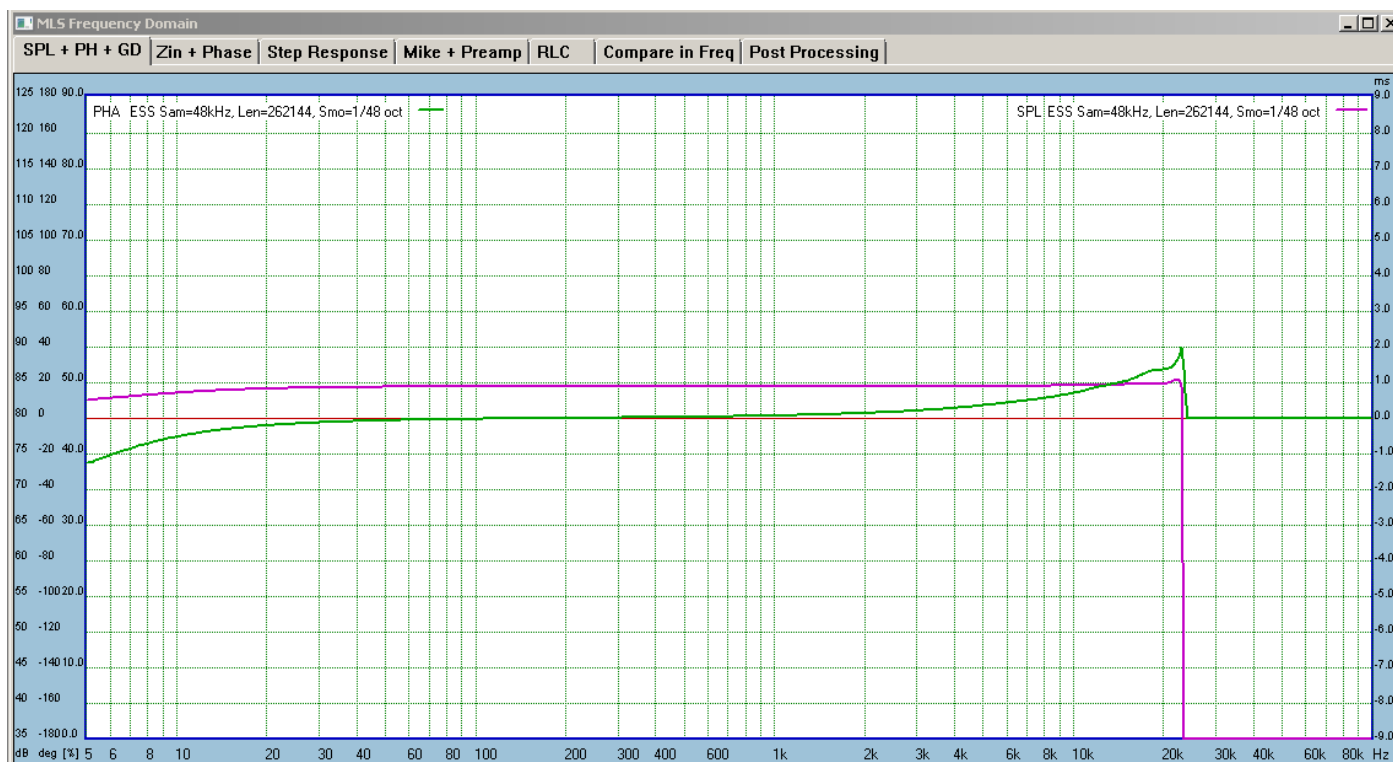
Features

- Built for maximum flexibility, with the best watts-to-dollars ratio around
- Six independent amplifier channels to suit a wide range of applications
- Six independent level controls on the back panel allow convenient level balancing of all channels
- Three Dual/Mono switches on the back panel give a broad range of flexibility in configuring your system
- Compact design is rack-mountable in two rack spaces (3½ inches/89 mm)
- Super-quiet, variable-speed fan with auto trigger for silent, effective cooling
- High-quality, standard-spaced double banana-jack/binding-post output connections facilitate any type of speaker connection, including heavy-gauge wire
- Three Year, No-Fault, Fully Transferable warranty completely protects your investment and guarantees its specifications



Loudspeakers used in my HT system are both 4-ohm (dual woofers) and 8-ohm (single woofers and tweeters). Power output measurements delivered 103Watts into 8-ohm for single channel driven. Subwoofers are powered by separate amplifier with 600W capacity.

		*1 kHz Power	
		4-Ohm	8-Ohm
CP660			
Six-Channel Mode			
1 Channel / 1 Load	130W	90W	
4 Channels / 4 Loads	100W	70W	
6 Channels / 6 Loads	75W	60W	
Bridge Mode			
2 Channels / 1 Load		250W	
4 Channels / 2 Loads		200W	
6 Channels / 3 Loads		150W	
*1 kHz Power: refers to maximum average power in watts at 1 kHz with 0.3% THD.			

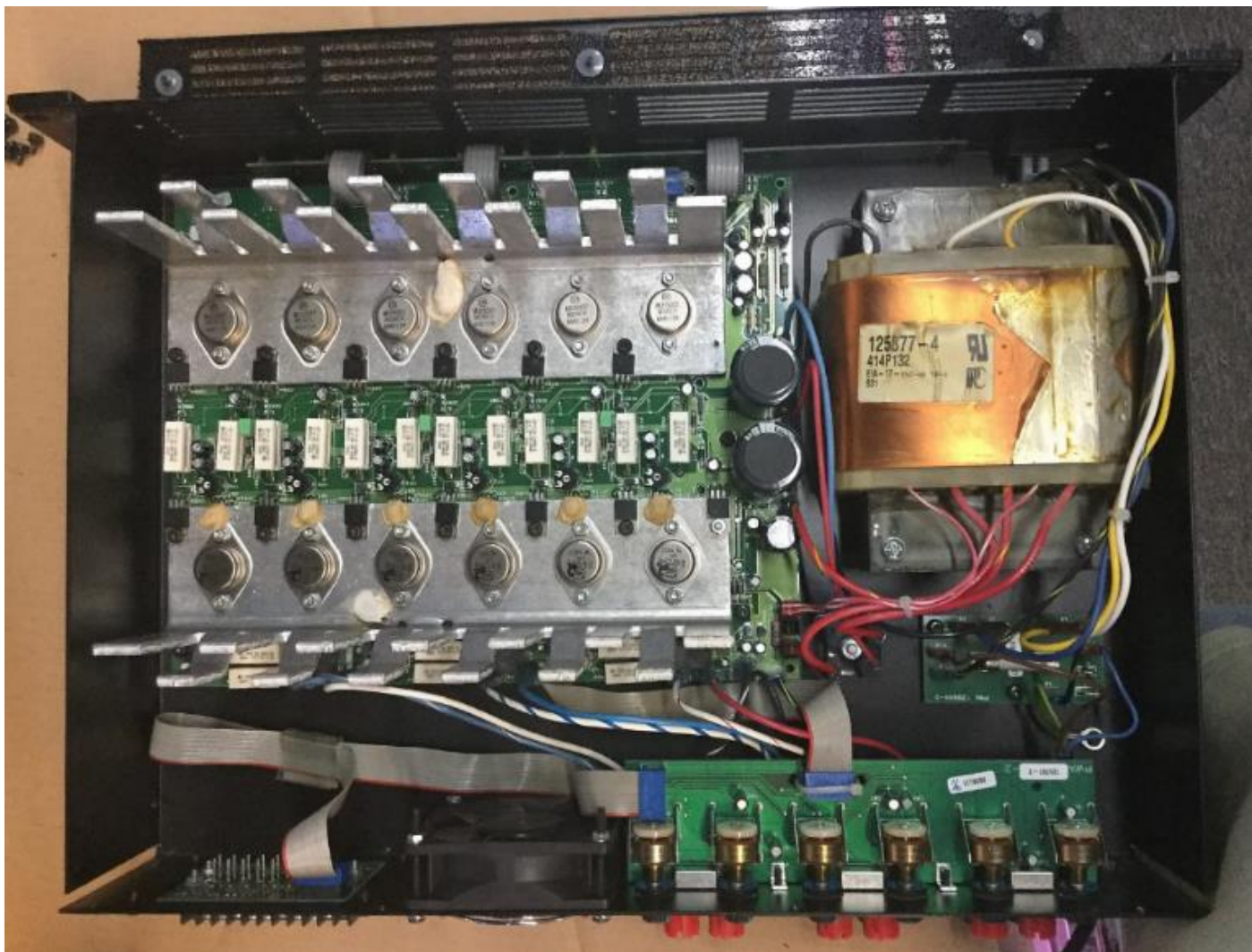


Frequency response of the power CROWN CP660 amplifier.

For the previous incarnation of the UE system, I have also developed full analogue amplification described in this paper: https://www.bodziosoftware.com.au/Power_Amplifiers.pdf

However, there was no DAC in this project, so the amplification system required analogue signals, typically provided by 2 x Delta1010LT sound cards, being tightly synchronized. In the current UE system, the Delta card analogue outputs were replaced by LynxAES16e sound card which is fully digital card, providing AES/EBU outputs.

This is my third attempt to provide possibly the most elegant solution to the HT system with 16-channel, single soundcard approach.



CP660 amplifiers installed in the HT cabinet.

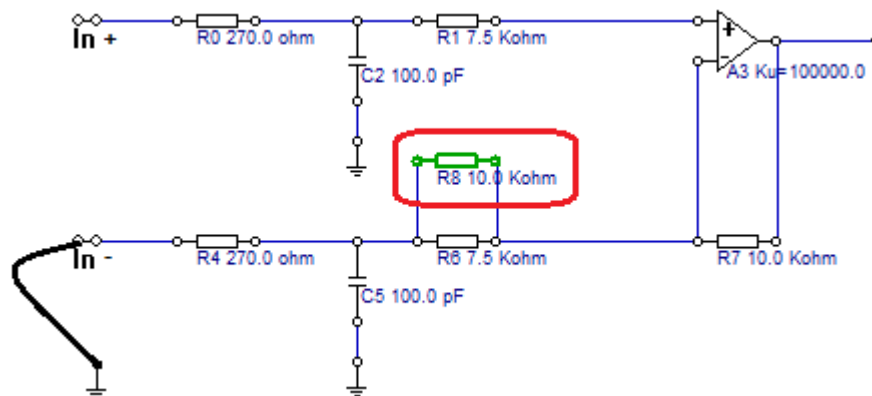


Since I now use LynxAES16e sound card, I need several DACs to convert digital outputs from the Lynx card to analogue inputs of the CP 660 amplifiers. Turns out, that I need to make CP 660 inputs slightly more sensitive. Some modifications to the input section of the CP 660 amplifiers will be required.

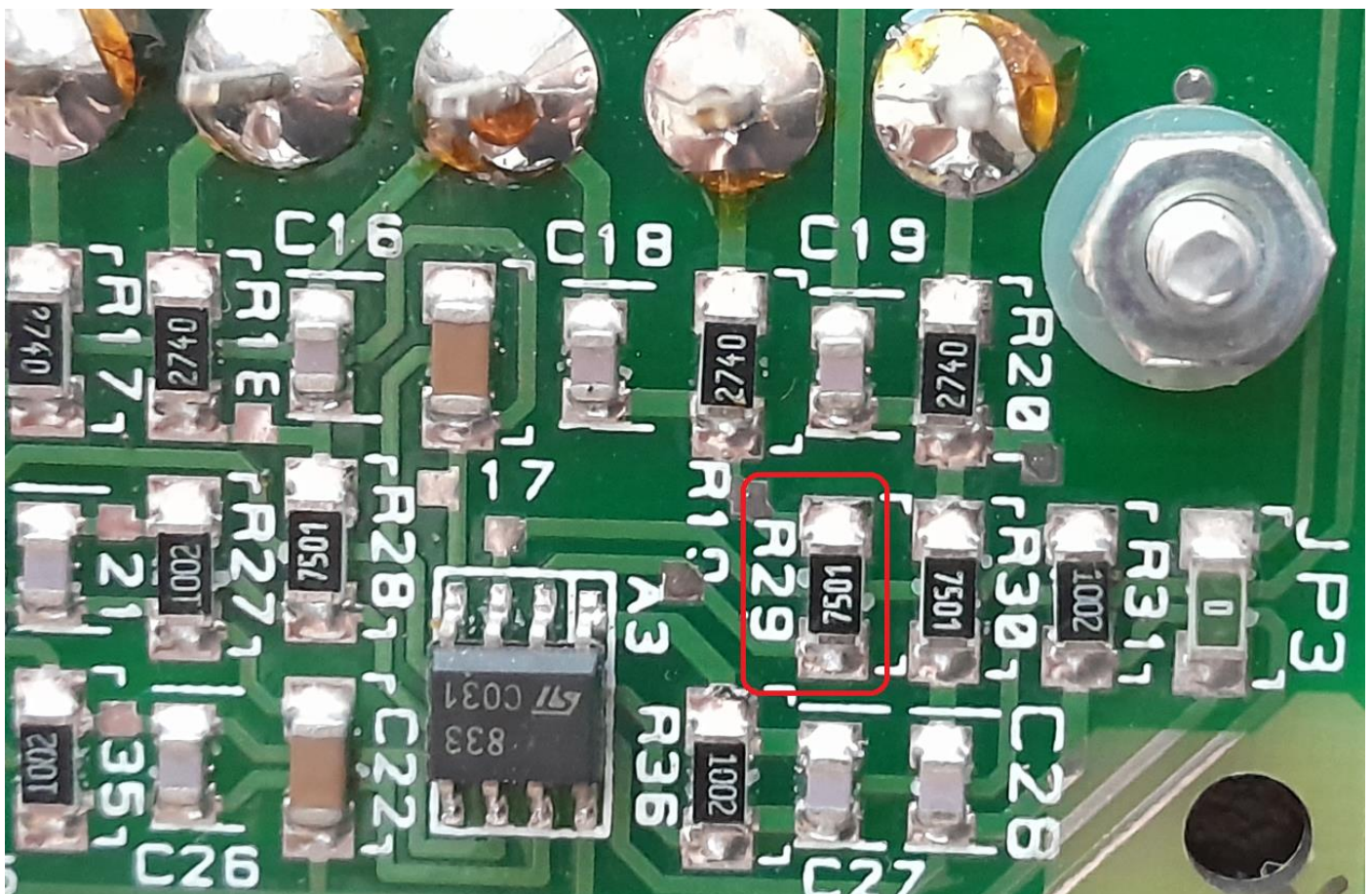
PRO 1259 DACs

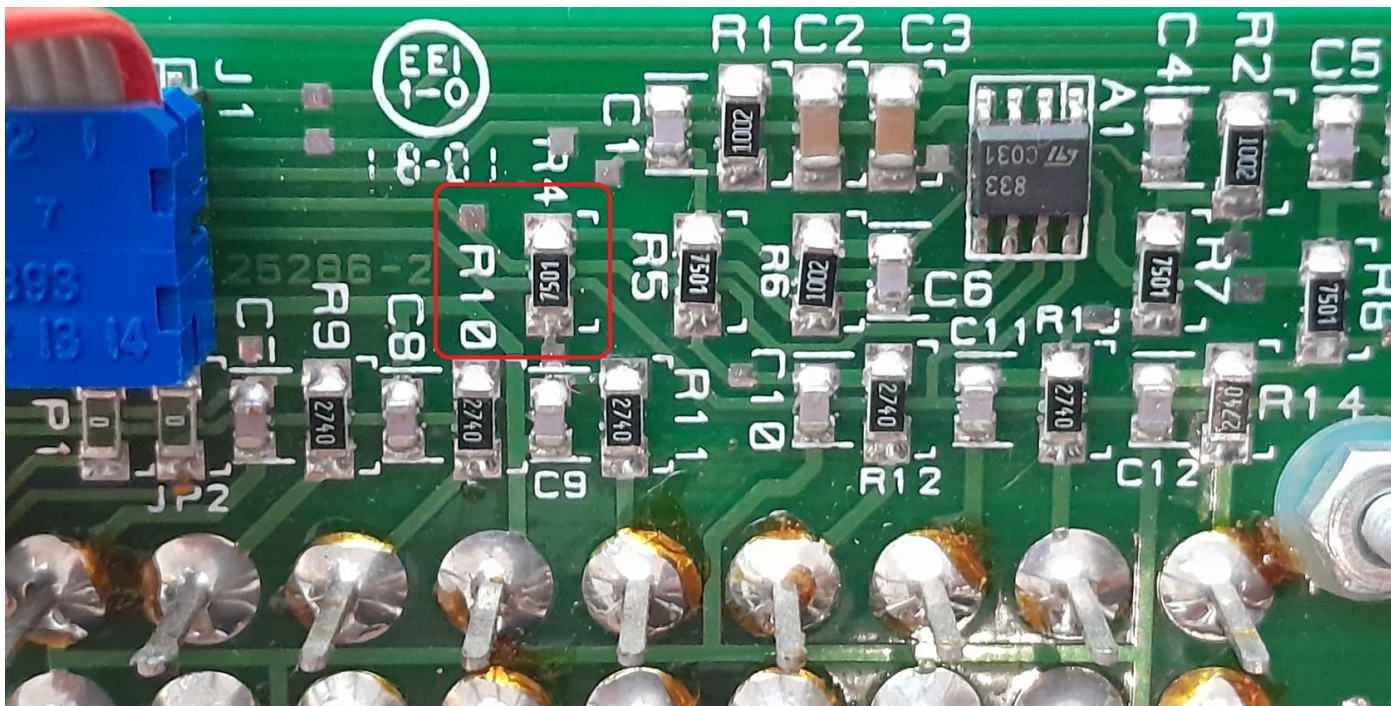
All DACs used in my system are PRO1259 DACs. From the information available on the internet, I found, that PRO1259 design is based on Cirrus Logic CS4344 integrated circuits. Their audio performance is 105dB of dynamic range and -95dB THD+N. They are well placed in the home theatre environment. In addition, the DACs deliver up to 3.1Vpp of output audio level.

This is a borderline level, and a little bit more may be needed to fully drive CP660 amplifiers. A 3dB increase in input sensitivity can be accomplished adding a 10kOhm parallel resistor to the following 6 resistors of the CP660 input board: R7, R10, R21, R24, R26 and R29. This will work just fine, because the negative input (-) needs to be connected the ground input for all 6 inputs. We are simply converting balanced XLR-type of input, tho unbalanced RCA-type on connections to match the DAC's unbalanced output.



Two examples of input PCB of the CP660 are shown below. Resistors R29 and R10 are marked. The input PCB is attached with 4 screws and can be easily detached for easy access to the component-side of the PCB.





This method of increasing sensitivity of the CP660 can be used for other DACs. So if you have already a preferred DAC, which is producing lower output voltage, you can use it in the system.

More information about the PRO 1259 DAC is available from:

<https://pro2.com.au/508/allproducts/avaccessories/avconverter/pro1259-audio-converter-digital-to/>

Digital Audio to Stereo Audio Converter with Loopout Function

PARTS SUPPLIED:

Audio Converter (1)

Power Supply (1)

SPECIFICATIONS

- Converter Type: D to A Converter
- Digital Input Type: Coaxial & Optical
- Support Digital Audio Format: LPCM
- Input Impedance: 75 ohms
- Minimum Load Impedance: 10K ohms
- Loopout Function: Available
- Frequency Response: 44.1 - 192KHz sample rate
- DC Input Connector: 5.5 x 2.1 x 9.5 mm
- DC Input Voltage/Polarity: 12V /Center positive
- Dimensions: 88.4L x 64.5W x 29H mm
- Weight: 60 g

FEATURES

- Digital Audio (PCM) To Analog Audio Converter With Loopout Function
- Converts digital coaxial or digital optical signals to analog L/R audio. The Converter is a high-quality DAC (Digital to Analog Converter), allowing for simple audio signal conversion with no degradation, and supporting variable sampling rates for maximum fidelity.
- One input (digital coaxial or digital optical audio, digital coaxial priority).
- One output (analog L/R audio).
- With no signal or signal format error indicator.



New 192 kHz Stereo DACs Are Ideal for Value-Line Entertainment Products

Premium Audio Performance With 50% Smaller Footprint Than Previous Generation

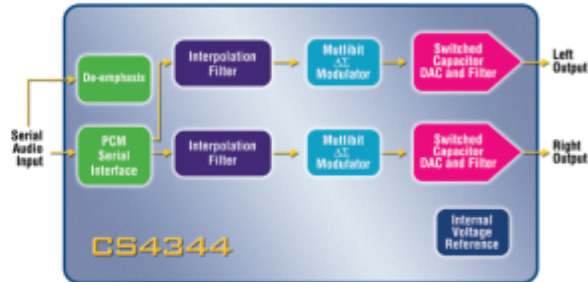
CS4344/5/6/8 Features

- Advanced multi-bit Delta-Sigma architecture
- 105 dB dynamic range
- -95 dB THD+N
- 24-bit conversion
- Automatically detects sample rates up to 192 kHz
- Single +3.3 V or +5 V power supply
- Single-ended outputs
- Popguard® technology
- Low clock jitter sensitivity
- On-chip digital de-emphasis
- Family supports all standard audio interface formats
- Available in 10-pin TSSOP
- CS4344/5/6/8 price: \$1.02 (10 K)

Applications

- DVD players & recorders
- DVD receivers
- Digital televisions
- Set-top boxes
- Automotive entertainment systems
- Professional audio products
- Musical instruments

Actual Size 



The new Cirrus Logic® family of digital-to-analog converters, the CS4344, CS4345, CS4346 and CS4348, delivers superior audio quality while providing OEMs with the industry's smallest, most cost-effective 192 kHz stereo DAC.

Helping reduce printed circuit board space requirements, the chips are offered in a low profile 10-pin package that is 50 percent smaller than Cirrus' current eight-pin DAC family. Based on an advanced multi-bit Delta-Sigma architecture, the CS4344 family provides a single-ended output architecture and delivers -95 dB THD+N and a dynamic range of 105 dB. The DACs operate from a single +3.3 V or +5 V power supply and include value-added features such as patented automatic sample-rate detection, on-chip digital de-emphasis and Cirrus Logic's Popguard technology to eliminate power cycling clicks and pops, which further reduces the number of external components required.

The CS4344, CS4345, CS4346, and CS4348 differ only in the serial audio interface format they support, which includes I²S, left-justified, and 24-bit and 16-bit right-justified, respectively. Existing Cirrus Logic customers have a simple upgrade path because the CS4344 family is functionally compatible with other popular value-line DACs from Cirrus Logic, including the CS4334, CS4340, and CS4340A.

The CS4344 family strengthens Cirrus' industry leading D/A converter product line and provides manufacturers a simple, small, and cost-effective solution, which is precisely what you need to get premium audio products to market fast. You will have to look closely to see this tiny 10-pin DAC, but your ears will easily discern the remarkable sound quality that this DAC delivers.

Cirrus Logic, Inc. 2901 Via Fortuna Austin, TX 78746 USA
T (512) 851-4000 T (800) 888-5016 F (512) 851-4977

**For more information,
visit us at www.cirrus.com**

© 2003, Cirrus Logic, Inc. All rights reserved. Cirrus, Cirrus Logic, and Leading the Digital Entertainment Revolution are trademarks of Cirrus Logic, Inc. Other brand and product names may be trademarks or service marks of their respective owners.

0114-1203-PB

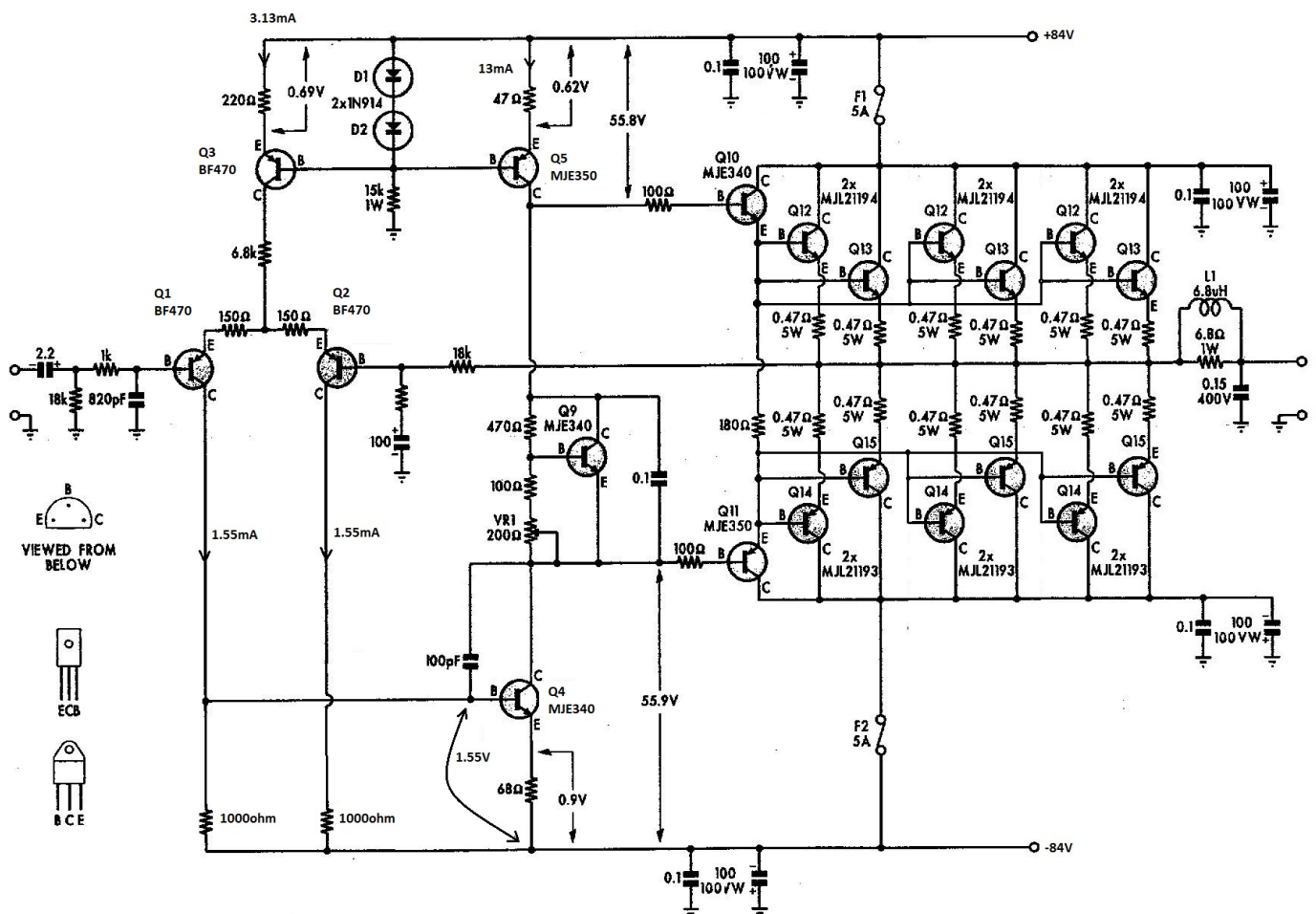
Finally, we arrive at subwoofer power amplifier. Currently I use single power amplifier, but plan to built second one, so I can explore BBM configuration of the UE10. Later on, maybe even two more, so the subwoofer-sink option can be implemented as well.

Subwoofer Power Amplifier

Subwoofer power amplifier shown below, was inspired by 175W/8ohm power amplifier described in Silicon Chip magazine in Australia, and available as a DIY kit. Unfortunately, the original amplifier turned out to have parasitic oscillations and severely lacked power. Therefore, the amplifier was re-designed, with new transistors, new topography, and significantly higher supply voltages.

The new amplifier is capable of delivering 600W into 4 ohm and 350W into 8 ohm loads. I have included the schematic of the amplifier to offer some ideas for DIY designers looking for some inspiration, and who are experienced enough to try such design on their own.

The amplifier design is very simple. There is no anti-thump circuit, and no short-circuit protection either. Just a minimalistic approach to obtaining large amount of power from a device, that is expected to be installed in the system and never touched again.



The output power includes some headroom. This is necessary for the SPL equalization of the massive, 18" McCauly subwoofers in have installed in my system.

https://www.mccauleysound.com/component_specifications.cfm?ID=126

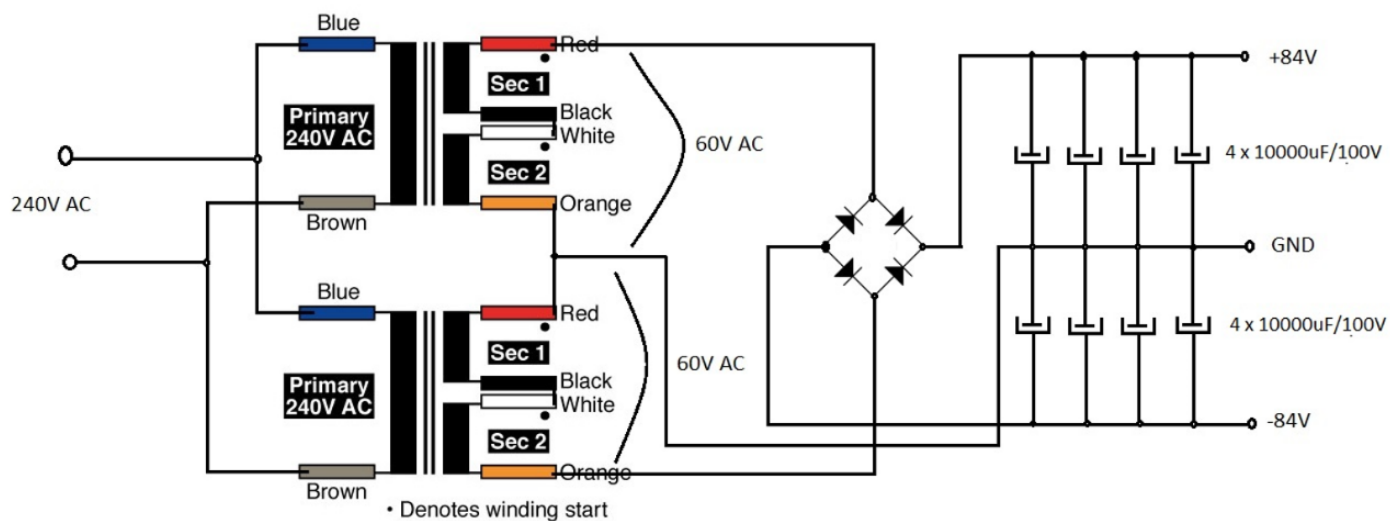
The design, construction, measurements of the subwoofer is documented in

https://www.bodziosoftware.com.au/LP_MP_Subwoofer_Tests.pdf

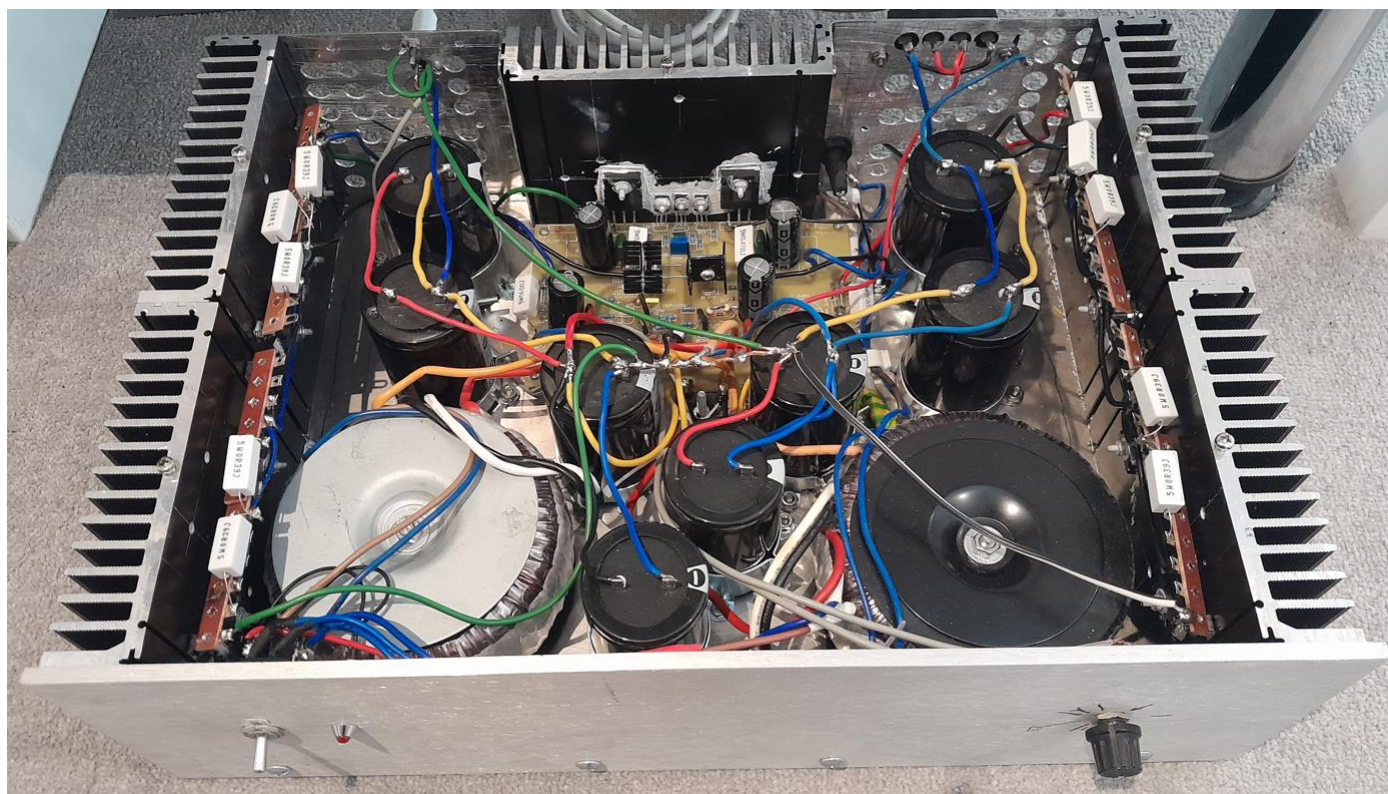
The above level of performance is possible by using a strong power supply, with two 500VA toroidal transformers and large capacitor banks of 4 x 10000uF/100 per each supply rail.

M5730

Altronics 500W 30V + 30V Toroidal Transformer x 2



There is no cooling fans in the amplifier. I found, that the heat-sinks installed as a side-walls provide more than adequate cooling capabilities for the 12 output transistors.



Thank you for reading.

Bohdan