

Barolo – SST

A Current-Sourcing Headphone Amp

by Barbara E. Gerhold, "TUBECLINIC"

*When designing a fully new series of Current-Sourcing Amplifiers (CSA)
it was quite necessary to design a new headphone amp too.*

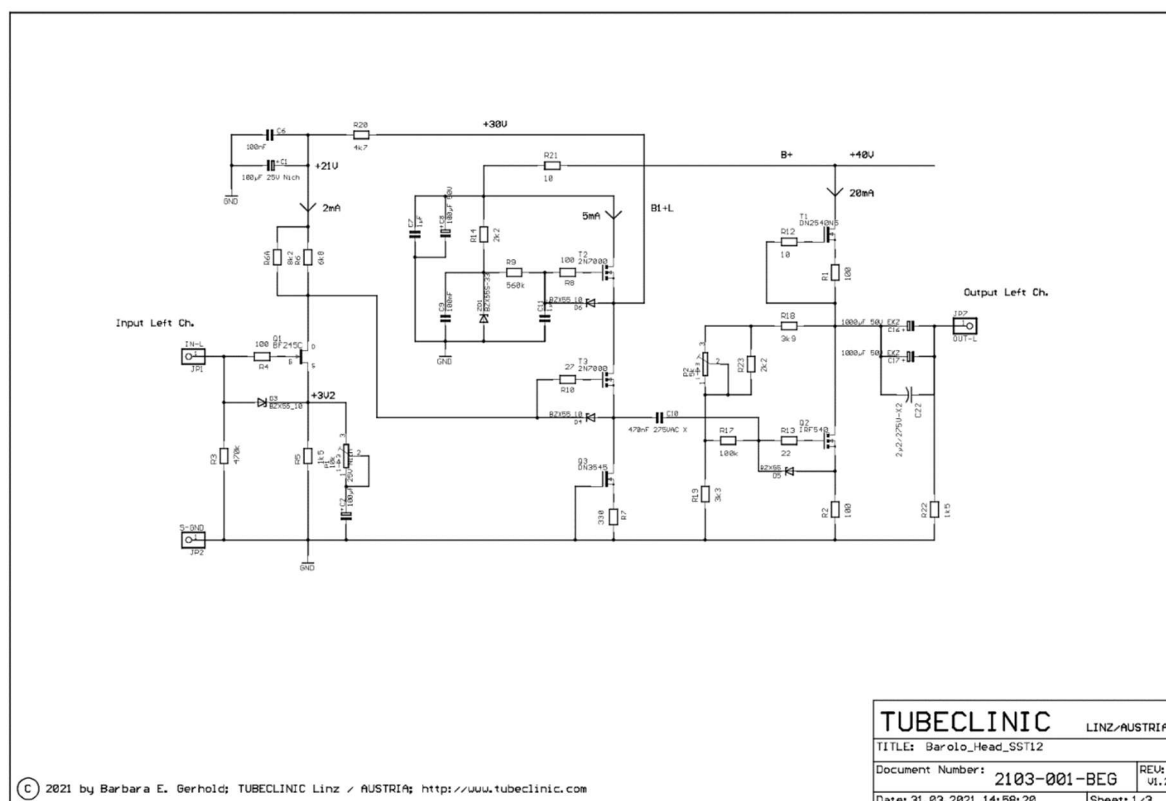
*Due to the impressive performance of the power amp CABERNET, it was obvious to try the CSA /
SST - technology on a headphone amp too. And it succeeded!*

*To stay in the progress of lending these brand-new Audio equipment parts
prominent names of as famous wines we shall call it BAROLO.*

SCHEMATIC

Admitted, this headphone amplifier is a miniature version of the *CABERNET* power amplifier. As you can easily see, it consists of the same amplifier stages and an almost identical topology. *BAROLO* is also a CSA, built in SST technology.

This means that the AC Current-Sourcing-Technology is also used here. Only with less power than *CABERNET* – but with the same outstanding imaging quality and the same sound performance.



What you see here is only 1 channel of *BAROLO*. The second channel is completely identical. I will now represent its function:

This headphone amplifier is designed for headphones with impedances of about 20 Ω to 1000 Ω and can therefore be used for (almost) all headphones on the market. Due to its AC Current-Sourcing-Technology, it is particularly suitable for complicated impedances (e.g. capacitive loads). In addition, no "overall NFB" is used here, which in turn benefits the stability of the circuit under extremely difficult load conditions and is also characterized by the complete absence of any oscillation tendency. Similar to the *CABERNET*, the *BAROLO* also has the ability to achieve excellent imaging in all spatial directions.

In terms of sound, this is characterized by rock-solid, spatial imaging quality and - as one of the very few devices on the market - the music is not created "seemingly in the head", but "in front of the inner eye" on a virtual stage.

The way it works

In principle, *BAROLO* is a very small single-ended Class-A amplifier with AC Current-Sourcing-technology in the output and without an "overall NFB".

The input stage

As with many of my developments there is a JFET at the input in conventional Common Cathode circuit. This helps to keep the input purely resistive and almost arbitrarily high-impedance, and to do all the amplification of the full design here. The gain is adjustable to optimally adjust different headphones. This stage also works and sounds exactly as you would imagine it to be from a triode.

The driver stage

I don't want to repeat myself at this point. It is almost equal to that of *CABERNET*. This stage, consisting of the NMOS T2 (stabilized gyrator) and T3 (control valve) "ride" on the D-NMOS constant-current-source (CCS) Q3. Due to the different power supply, no coupling capacitor is required to couple the driver to the input stage, which in turn benefits the performance.

True to the principle → "what's better than the best capacitor? → no capacitor".

The output stage

Analogous to the driver stage, the identical construction with the output of *CABERNET* also applies to *BAROLO*. Only with slightly smaller, adapted components.

The quiescent current of the stage is about 20 mA, sufficient to drive even a 20 Ω headphone with 400 mV_p (or 8mW). This is certainly still quite sufficient for receiving a permanent hearing damage. Therefore, it is advantageous to attach a potentiometer to the input of the device for volume adjustment. I operate my own *BAROLO* with an **AKG - K180** (600 Ω), a **SENNHEISER – momentum 2** (22 Ω) and various In-Ear versions from different manufacturers (mostly 50 Ω).

This development is characterized above all by the complete absence of distortion, which is due to the AC Current-Sourcing-technology on the one hand and the relatively high operating voltage of +40 V_{DC} used here on the other. As a result, this "miniature power amplifier" never reaches its limits and always remains level-headed solid and clear in sound.

The supply

You can either use the proposed stand-alone supply as shown at the schematic or use the integrated +48V_{DC} supply the whole SST system uses. That makes it easy to keep an eye on the GND connections as well as an integrated DC supply is perfect if you wanted / needed to install more than one part into the same enclosure. I recommend to use a SMPS (>200kHz, best was "medical grade" and +48V_{DC}/0,5A) but any linear supply of +48V_{DC} / 0,5A and sufficient filtering can be used too.

The Choice of Components

Caps are MKP-X2 by TENTA and/or WIMA as well as some additional gems of NOS MIL RuPIOs (pls. refer to the schematic).

El.Caps are only NICHICON Muse AUDIO GOLD, type UKZ, while in the supply section I used standard NICHICON, type VY.

Resistors are standard metal film 1%, type SMA-0207 or -0414. The current sensors (R1, R2) at the output stage are metal-film 100Ω 1% 0,6W.

JFETs by Philips, ON or Fairchild; **NMOS** are by IR and **D-NMOS** are by IXYS and/or by Supertex.

Diodes and **Z-diodes** are from several brands. Pls. refer to the schematic.

OUTRO

As already mentioned with the CABERNET power amplifier, a CSA is the absolute top choice when it comes to firing an FR-driver. Of course, the vast majority of sound transducers in headphones are FR too. Here, too, it is important to compensate for the varying impedance, which also increases with increasing frequency, and to correct the volume dependence in the bass range, which is occasionally noticeable in some closed headphones.

But also, open designs and even in-ear models also benefit from the CSA. In particular, the absolute and constant phase-rigidity of the output current contributes to the fact that you will experience a spatiality that you would not have thought possible from headphone playback.

No matter what brand, type or design of headphones you connect, you will be thrilled.

As you know - all information about the printable, full-size schematic and the PCB is again situated in a binder enclosed to this website.

If you have any further question, you can contact me via eMail.