ELTIM high-end Buffer/converter modules

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# LoutBin-120x Balanced > RCA line output module

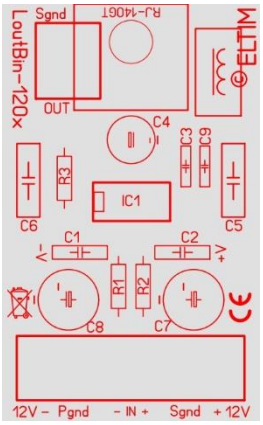
**With this very tiny module we most probably provide the best available line output circuitry available today. With its balanced input it appears to show a transformer-like, but even better behaviour.**

**Unlike about everybody else, we use the patented *InGenius™* principle to convert and buffer a balanced signal into a very high quality single line signal.**

- **Convert your balanced signal(s) coming from f.e. a DAC or DSP to a perfect Line signal(s) !**

With the **InGenius™** chip you obtain an about perfect Line output from your balanced output signal coming from f.e. a DAC or DSP with a CMRR ratio of over an unbeaten 90dB!
An unbalance in the balanced lines, which often occurs, is fully taken care of.
RF interfering signals are also taken care of in the best possible way and immediately behind the input connections and the output connector, as it always should be…….

**LoutBin-120x layout**
The tiny, 34x55mm PCB contains all the parts required and a quality RCA chassis connector. Most required parts are in the IC already, so it looks quite simple:
On top you can mount an RJ-140GT professional RCA output connector.
Instead you could mount a 2-pole screw terminal for internal use.
Under the RCA connector is an ESD blocking device.



*Scale 1:1*

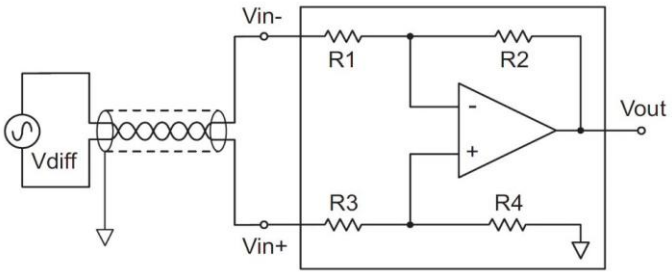
**Mounting**
Use a Ø 12mm hole to mount the RCA output connector and attached mini PCB, that's it. Since this PCB hardly has any weight, mounting the connector to the cabinet chassis is sufficient.
While using a 2-pole screw terminal the PCB is fixed with a single M3 bolt.

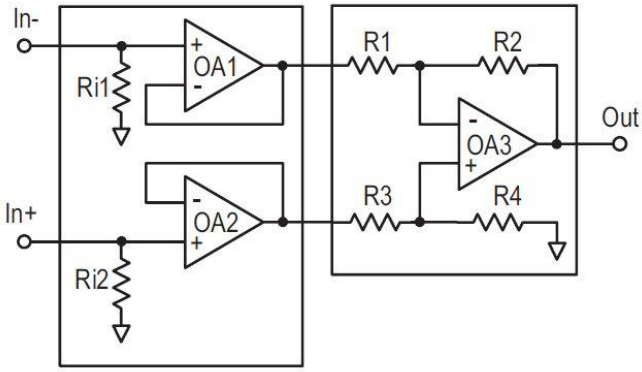
**Power Supply**
There are power supply connections ( +12V and -12V) for use in low voltage applications below +/-13V.
*Do not use higher voltages here, since these lines are paralleled by 15V Zener diodes which will draw severe currents otherwise!*

In a Power Amplifier there is mostly no low supply voltage available, so we arranged some extra's.
Since this module will be used in bridged amps as well, higher PS voltages can be applied to the extra V+/V- pins in the range of ±18 - 75Vdc. These are then connected to the amps power supply rails.
15mA Constant Current Diodes (CCD) provide a constant current over this wide voltage range. Then 15V Zener diodes regulate the internal supply to ±15Vdc. 5mA flows into the IC, the other 10mA via the zeners.

**Theory of operation**

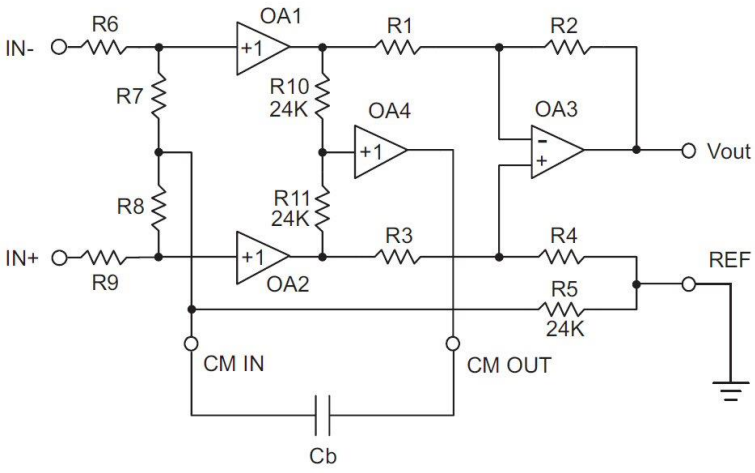
Since this module works completely different from most other balance > line converters we explain some more. Unlike about 95% of all balanced inputs in all kinds of equipment, we are **NOT** using a simple Opamp layout as in the picture at right, where a balanced (XLR) signal is converted by an Opamp to a single line signal for internal use. These circuits just and only convert two counter phase lines into a single line, that's it.
These circuits behave poor where an imbalance in the connections or prior circuits is a fact.

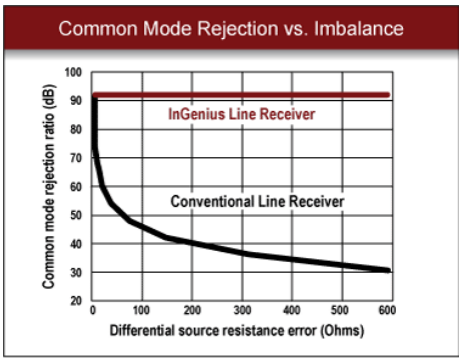



Neither do we use the circuit used in professional audio- and measuring equipment, known as an instrumentation amplifier, where the circuit mentioned before is preceded by a pair of extra Opamps. These circuits do behave better already, but still have an unpredictable CMRR ratio, depending on the line balance.
Besides the fact that there are extra Opamps in the signal path, degrading sound a bit, this is still not an optimal situation in order to gain a maximum CMRR (line unbalance) figure.

Instead, we are using THAT's patented **InGenius ™** design:




Here, OA1, 2 and 4 are quite simple circuits, possible by the function of OA4. All in one 8-pin DIP, incl. the resistors R1-9. OA3 still has the function as in both other circuits, yet is of very high quality.
The internal resistors are laser trimmed at 0,1% tolerance. No parasitic errors from external parts.

The THAT 1200-series **InGenius™** balanced line receiver IC's overcome a serious limitation of conventional balanced (Opamp) input stages: poor common mode rejection in real-world applications. While conventional input stages measure well in the lab and perform well on paper, they fail to live up to their CMRR specs when fed from even slightly unbalanced source impedances — a common situation in almost any High-end and Pro sound environment. This is because conventional stages have low common-mode input impedance, which interacts with imbalances in source impedance to unbalance common-mode signals, making them indistinguishable from desired, balanced signals. Especially where connectors are (dis)connected often and/or become dirty over time, this causes a loss in sound quality rapidly due to an imbalance in the first two circuits.

Developed by Bill Whitlock of Jensen Transformers, the patented **InGenius™** balanced input stage uses clever bootstrapping in order to raise it's common-mode input impedance into the megohm range without the noise penalty from the obvious solution of using high-value resistors.

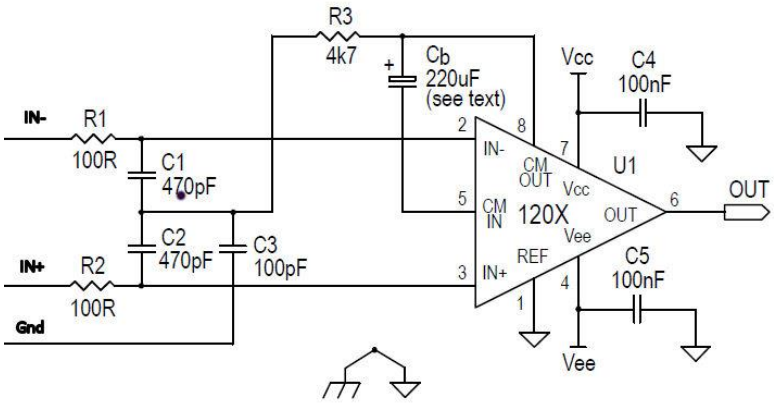
Like transformers, **InGenius™** line receivers maintain their high CMRR over a wide range of source impedance imbalances — even when fed from single-ended sources. So while using this circuit, you could feed a single line signal as well (into IN+) in this setup.
Unlike transformers, these wide bandwidth (>22MHz) solid state devices offer dc-coupling, low distortion, and transparent sound in a small 8-pin package.

So, for those who are allergic to Opamp circuits: this is NOT what you are used to! Perhaps you were right…..

## Circuit

The practical schematics as we used for our LoutBin-120x circuit is as recommended in THAT's datasheet. Due to the internal resistors, schematics look quite simple:

We only added some Supply parts and an LC output filter. C4/C5 are MKP types.




The RCA chassis connector for the Line output is mounted on the board. With this connector the module is mounted in the back of your gear. Instead of this RCA, you could mount a 2-pole screw terminal for internal use. In that case fix it with a single M3 bolt.

The internally generated balanced input signal is connected at the centre of the 6-pole screw terminal.

The laser trimmed resistors, setting the gain, are on the THAT 1200 chip. By using different types of it, we can set the gain at 0dB, -3dB or -6dB.

RFI filtering components C1-C3 are high quality components. We used 2% mica capacitors for the input filtering, which are degrading sound at minimum, are long lasting and very reliable. But these are also relatively expensive compared to MKP or even mostly used ceramic types. The 220uF bootstrap cap is a Nichicon "Fine Gold" and required for the InGenius technique. NOTE: it is NOT in the signal path!

## Power Supply

There are power supply connections ( +12V and -12V) for use in low voltage applications below +/-13V.
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In a Power Amplifier there is mostly no low supply voltage available, so we arranged some extra's.
Higher PS voltages can be applied to the extra V+/V- pins in the range of ±18 - 75Vdc. These are then connected to f.e. the amps power supply rails.
15mA Constant Current Diodes (CCD) provide a constant current over this wide voltage range. Then 15V Zener diodes regulate the internal supply to ±15Vdc. 3mA flows into the IC, the other 12mA via the zeners.

## Models

This **InGenius™** chip is available in three versions with different amplification values:
0dB (mostly 1Volt), -3dB (2 Volt line signal) and -6dB (4 Volt line signal).
Normally we supply the 0dB variant, -3/-6dB on request where higher than normal signal levels are used, as f.e. in PA- and Studio equipment. Just change the chip to a 1203 or 1206 type, that's all.

- LoutBin-1200 Balanced in/Line out with 0dB gain
- LoutBin-1203 Balanced in/Line out with -3dB gain
- LoutBin-1206 Balanced in/Line out with -6dB gain

We add a letter referring to the connector type: R = RCA, S = Screw

## Some figures

| | |
|---|---|
| Input impedance: | 48 kohms |
| Frequency range: | > 22MHz. |
| Slew rate: | > 12V/uS |
| Distortion: | < 0,0005% THD |
| Noise figure: | < 107dBu |
| CMRR: | > 90dB @60Hz under all circumstances |
| Power Supply voltage: | +/- 3 to 13Vdc @ ±12V connections (3mA) |
| | +/- 18 – 75Vdc @ +V and –V connections (15mA) |
| Dimensions | 55x34x27mm (LxWxH) incl. RCA connector |

**DIY**

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