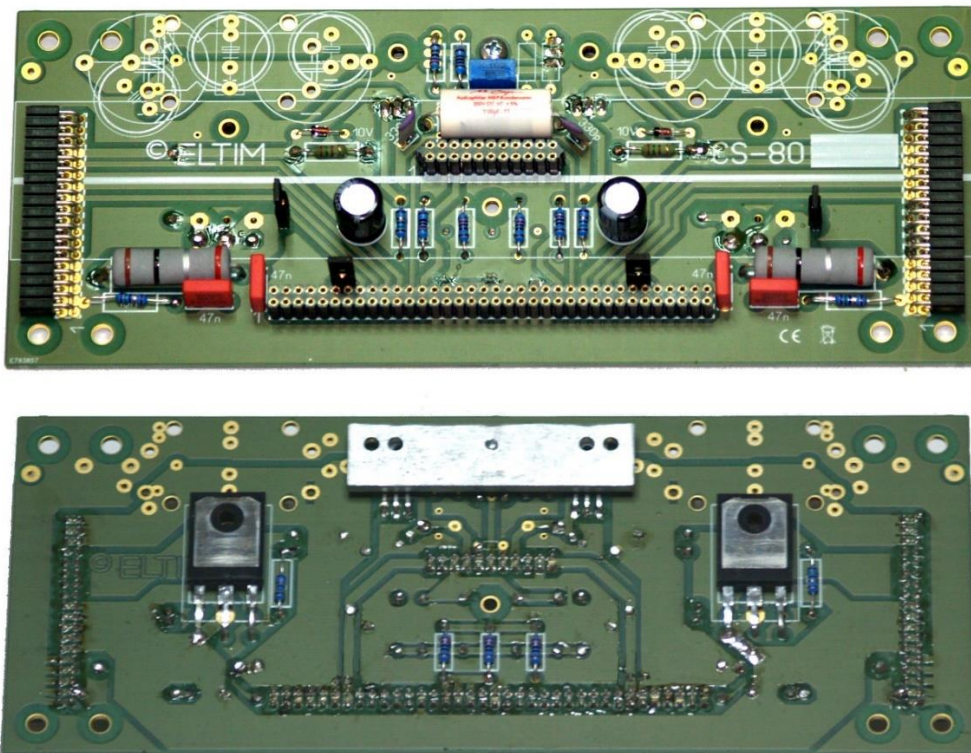


## CS-80 v2 Current Stage module

Due to our completely different way of thinking when it comes to PCB design and layout, mechanical and thermal stress, magnetic interference, EMI, etc., an ELTIM amplifier built with these modules looks and acts a bit different, which is [confirmed by customers](#). According to them they make *MUSIC*, not just **power** ! And that for a (very) long period of time due to the stress free setup and quality components. We did not concentrate on the lowest possible (yet low) distortion, yet musicality instead.

In order to make a true difference, we split our power amplifier schematics in a voltage- and a current stage board in order to obtain the maximum possible sound quality. This means that an ELTIM amplifier is based on these two (VS + CS) modules. A VS-input stage processes the sensitive and often small signal voltages and transfers it into signals powering a CS-module, which is leading the transient rich high currents. This cooperation works very well indeed as many indicated as a “tube like” sound, yet with extras. While using large TO-247 or even TO-264 sized power Fets, our amplifier systems are extremely stable, can deliver lots of power and more important, together with our totally different pcb setup, they have way better control over your speaker system compared to most other amplifier designs. We only use very high quality materials lasting for 20 years and heat resistant, double sided FR4+ PCB's made by a highly regarded European manufacturer, double sided (2x35um), tinned isles, text on both sides, etc.



Example of a CS-80 LEX08 with gold plated solder pads. Normally they are tin plated. Extra power supply capacitors (not included) close to the power transistors can be added by you (or us). Per 2019 we no longer mount preselected caps on our modules in order to give you freedom of choice.

Left or right of this CS-80 you can connect the speaker lines directly or via an extra [IO-80 module](#) which also has line- and/or balanced inputs connected to a VS-xx. A Power Supply board (f.e. [PS-80](#)) can be connected to the large horizontal connector.

The module is mounted directly to a heatsink, making it very rigid, dissipating heat in a most optimal way. Many note that our amplifiers only become hand warm, even at high power. Also, no microphonic effects.

We like to refer to our [special document](#) where we explain all the details we implemented in our designs.

This [CS-80](#) v2 power (current) stage PCB highlights:

- Positions for GSD (mostly Mosfets) and GDS types (mostly Hexfets), TO-247 or TO-264.
- Microphonic free mounted to a heat sink, which is electrically separated from the PCB.
- Power transistors located in the heart of the heat sink for optimal dissipation rate.
- Multiple positions power supply capacitor bank very close to the power Fets:
  - 2x  $\varnothing 22 \times 42$ mm axial capacitors for low cost purposes.
  - 2x3  $\varnothing 16/18$ mm, pitch 7,5mm affordable or high/audio grade radial capacitors.
  - 2x2  $\varnothing 25$ mm, pitch 10mm, low ESR, classy or high value capacitors.
- MKP capacitor in the idle current network.
- Current driven feedback in the centre of PCB with multiple paralleled resistors, reducing noise.
- Speaker output and extra Mosfet/Hexfet connector both left and right.
- The absence of a coil in the output line results in way better impulse behaviour.
- Separate Current stage (CS) and Voltage stage (VS) voltage rails.
- Separate tracks for Power-, speaker-, RF-ground, feedback, VS-stage and input ground.
- All grounds are leading to the centre area of the bottom connector.
- Wide and thick (35um) speaker-, ground- and power rails tracks.
- Milled, gold plated beryllium copper connectors, with multiple pin (12x 3A for supply) connections. Way higher quality than regular (1A) headers.
- Speaker signal for signalling/protection purposes at all connectors.
- PCB position to mount an NTC/PTC at centre, connected to both horizontal connectors. Will be connected to a Protection module if mounted.
- Fits exactly to MODU 3PD02200 heatsink (3PD02300 with CD modules).
- Frequency range limited by us to 4 (or DC) to  $>400.000$ Hz, Slew rate  $>60$ V/us.
- Dimensions: 200x80x12mm. Effective height depends on power capacitors used.



At following pages we list the data of the different CS-80 modules as we have in our program. After some years of selling them, we decided to change the way we supply and offer them. Basically, all these modules are the same, except for the types of Power Fets, which are mounted at the back side. Due to the specifications of these power transistors, the “figures” of the two remaining base modules are different and based on the max. voltage/current they can handle while mounted in an optimal way. Graphs where output power related to the supply voltages are given below. Hexfet versions are only available as a kit from now on, see more info below.

On a CS-80 PCB there is space to mount extra supply capacitors close to the power transistors. Doing so will improve the overall sound quality and especially improve the “punch” response due to the fact that there is energy available very close to the power transistors. Before, we had a wide range based on power transistor / supply capacitor differences. This appeared to be confusing for a lot of customers and we got many questions. Now we offer them without supply capacitors, as all other manufacturers do. Actually, with those you can’t even mount extra caps. As listed above, three capacitor types fit in the left and right top corners:



2x  $\varnothing 22 \times 48$ mm axial



2x3  $\varnothing 16/18$ mm radial



2x2  $\varnothing 25$ mm radial + 2x MKP

They are connected in the shortest possible way with wide tracks to the power transistors and due to that, they will increase peak power and transient response. We will also offer modules with these capacitors already mounted. You can select the capacitors of our choice with the article in our webshop.

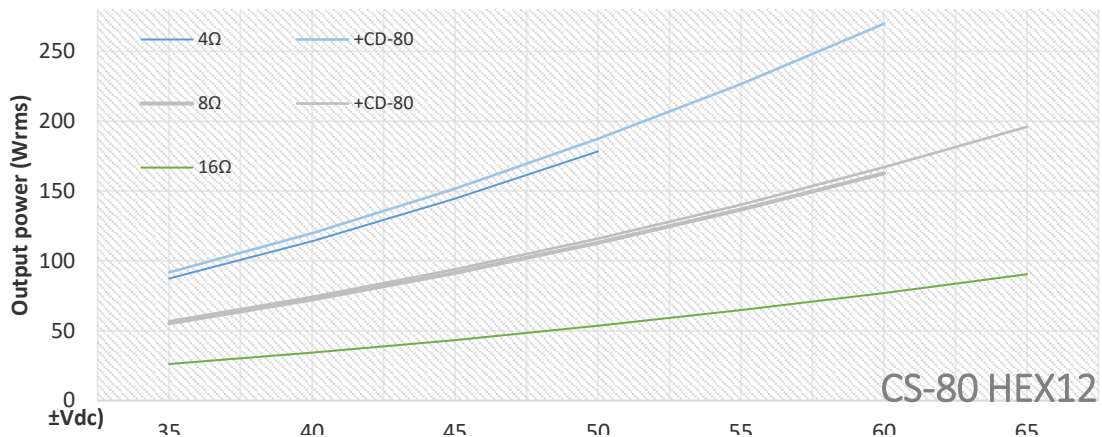
### Extra power

Left and right of a CS-80 module you could mount an extra pair of Fets, which are on a [CD-80 module](#) pair.



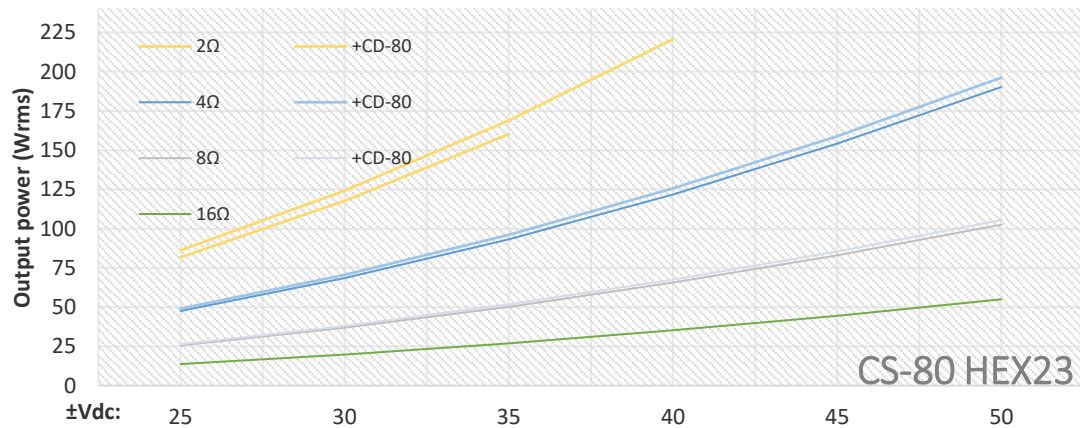
## Output power for models with INTERNATIONAL RECTIFIER HEXFETS:

By feeding a specific supply voltage you decide the max. output power.



**CS-80 HEX12**, with IR 12A/200V/1 25W, TO-247 Hexfets (IRFP240/IRFP9240)

The power is limited to around 160Wrms due to the limits of the Hexfets.  
Recommended for 8 or 16 ohms loads.



**CS-80 HEX23**, with IR 23A/100V/125W, TO-247 Hexfets (IRFP140/IRFP9140)

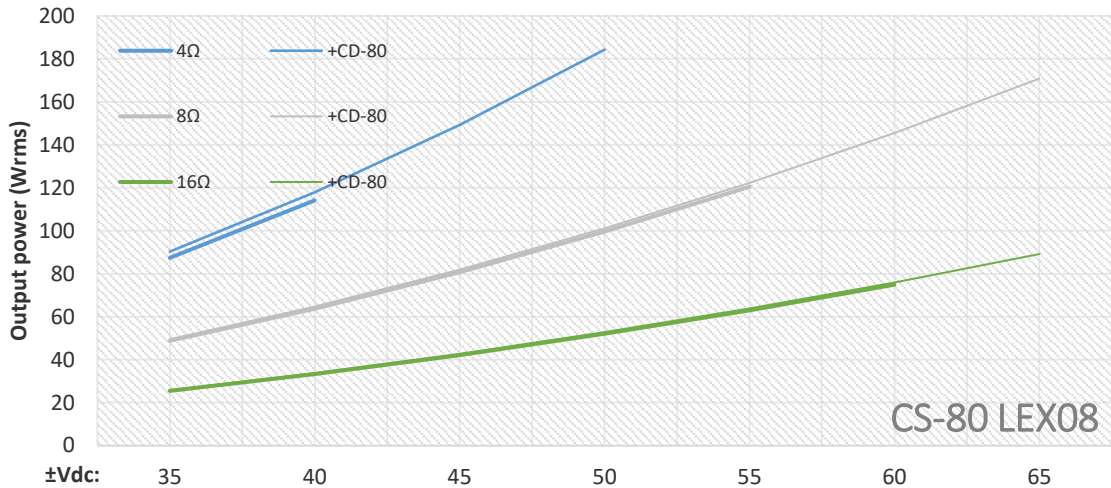
The power is limited to 160Wrms due to the Hexfets data and heatsink size.  
Due to the low max. supply voltage of  $\pm 50$ Vdc, yet high current (23A) capability, suitable for 2 or 4 ohm loads.

### Technical specifications:

Frequency range:	DC - >150kHz within 0,5dB
-3dB point:	440kHz
Distortion figure (THD):	< 0,001% (1W/1kHz/8ohm) < 0,002% (80W/1kHz/8ohm)
Slew rate:	> 18V/uS (@ +/- 30V). Limited by AC-input filter on VS-module used.
Harmonics:	<< -60dB, NONE specific, see graph right below. Actually unmeasurable.
Damping factor:	> 150 (strongly depending on power Hexfets and supply used)
Input voltage:	1 Volt
Input impedance:	47kOhm
Output load:	depending on model and supplied voltages, see graphs
Supply voltage:	depending on the model, see graphs
Output power:	depending on the model and supplied voltages, see graphs.
Dimensions:	200x80mm, height depends on type of supply capacitors used.

**NOTE:** For some time it appeared that the Hexfets we use here were obsolete, but now available again!

## Output power for models with audiophile [EXICON lateral Mosfets](#):

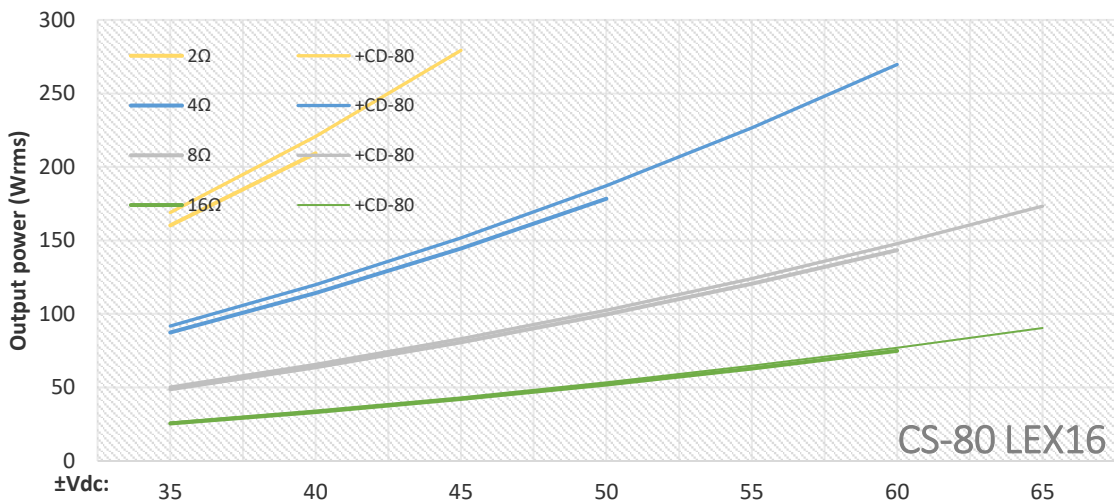


### **CS-80 LEX08**, with EXICON 8A/200V/125W, TO-247 lateral Mosfets (ECX10N20 / ECX10P20)

The power is limited to around 125Wrms due to the limits of the Mosfets used. Safe side calculations!

With help of an extra CD-80 LEX08 pair the power capability increases to around 180Wrms.

The damping factor of the amplifier will also increase by using a pair of CD-80 LEX08's.



### **CS-80 LEX16**, with EXICON 16A/200V/250W, TO-264 lateral Mosfets (ECW20N20 / ECW20P20)

The power is limited to around 150Wrms due to the size of the PCB tracks.

With help of an extra CD-80 LEX16 pair the power capability increases to around >250Wrms.

On the other hand, the damping factor, and so speaker control, will increase by using it.

#### Technical specifications:

Frequency range:	DC - >2MHz within 2dB (limited and defined by VS-module used, 270kHz/450kHz)
Distortion figure (THD):	< 0,0005% (1W/1kHz/8ohm) < 0,001% (80W/1kHz/8ohm)
Slew rate:	> 70V/uS (@ +/- 30V). Limited by AC-input filter on VS-module used.
Harmonics:	<< -55dB, NONE specific, see graph right below.
Damping factor:	> 200 (strongly depending on power Mosfets and supply used)
Input voltage:	1 Volt
Input impedance:	47kOhm
Output load:	depending on model and supplied voltages, see graphs
Supply voltage:	depending on the model, see graphs
Output power:	depending on the model and supplied voltages, see graphs.
Dimensions:	200x80mm, height depends on type of supply capacitors used.

## Bridged mode

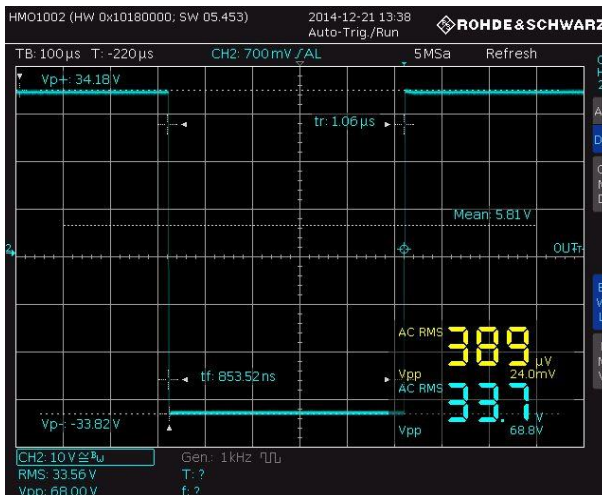
With this CS-80 module, it is most easy to make a bridged mode Monoblock amplifier. On our request MODU developed a series of cabinets, a mix of Dissipante and Galaxy series. We made a special power supply module fitting between both CS-80's. Just connect a transformer. To make this work, one of the CS- AND VS-modules has to be made in reversed supply mode, which can be done without modifications. Yet, make sure you know what you are doing! Just the polarity sensitive parts need to be mounted reversed and transistor locations exchanged, that's all. We made a [special document](#) explaining what to do.



Some drive a bridged amp by just feeding a balanced signal to both modules. Doing so, you forget that the Interfering signals are passed 100%, and so the advantage of a balanced line is down the drain.

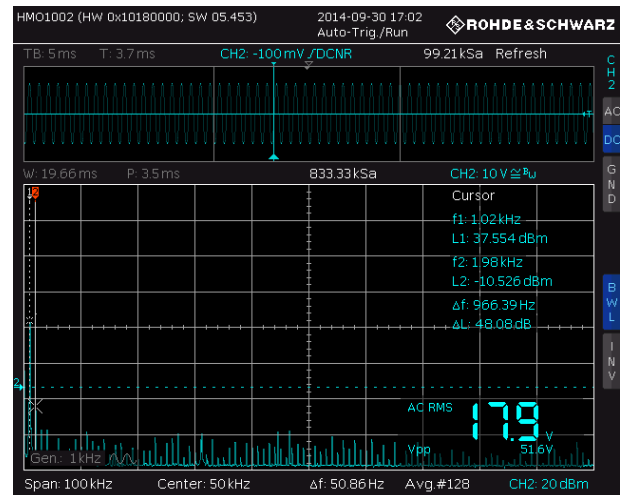
If you want to drive this bridge mode amplifier as you should, we also provide an input module with line- and balanced input, and has an in phase and out of phase signal to drive both amp modules. All signals go through the same electronics, avoiding phase errors. This IO-80bal module can be stacked to the side connectors, without any wiring. Then just connect a transformer and the in/out connectors.

## Some measurement data:



Square wave signal without ANY irregularities  
It also shows a slew rate of around 60V/µs.

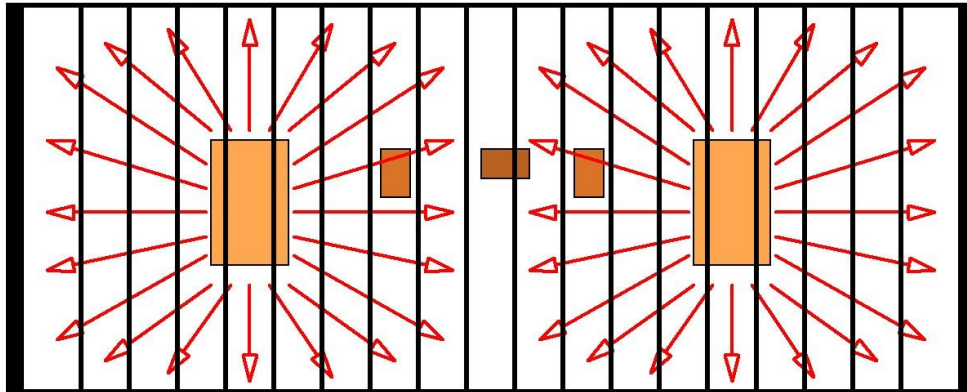
Limiting factor is the low-pass network in the input circuit!



Frequency domain (100kHz wide) without any significant harmonics.  
Please note that we run on 40W/8ohms here, not 1W as others do!

## HEAT SINK data

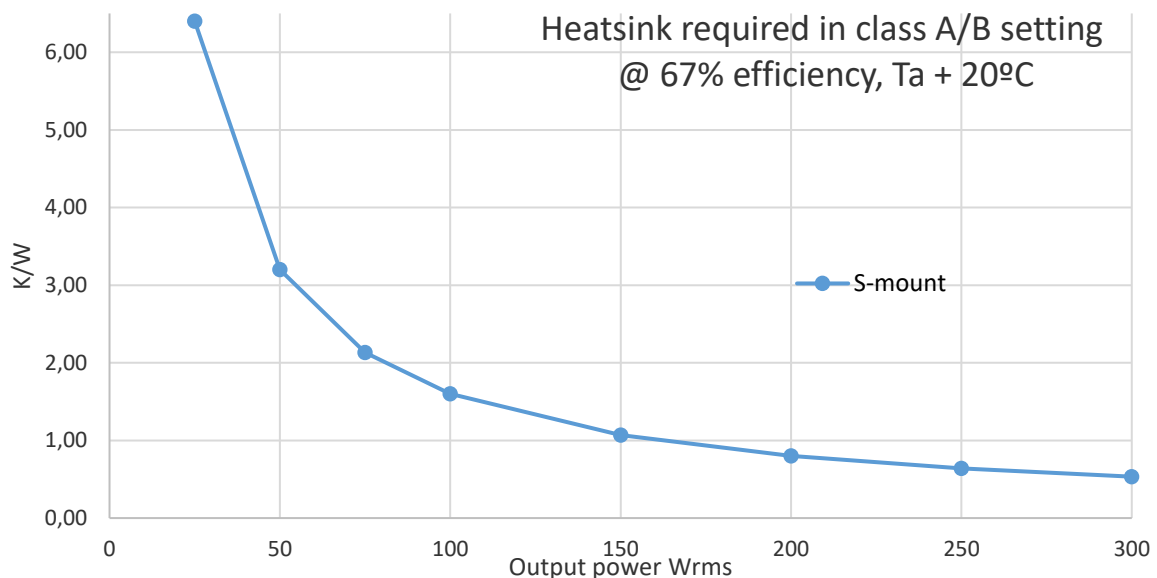
Unlike most amplifier modules available today, in this design heat is spread symmetrical over the heat sink by spreading the transistors over the heat sink symmetrically. Doing so increases effective thermal load of the power transistors. In practise, with us the amps will become only hand warm.



Mounted on the exactly fitting MODU [3PD02200](#), 200x80x40mm heat sink (0,67K/W), it is a nice solid and exactly fitting combination, but the module cannot be used at full potential due to the limited heat dissipation of this heatsink. For more than around 150Wrms, you need a larger heat sink.

With CD-80 add-ons use [3PD02300](#) (300x80x40mm, 0,45K/W). This combination also fits exactly and increases the power load to about 200Wrms. But: with the extra CD-80 pair you won't reach the electrical limits, since it all would become too hot. For max. power you need a larger heat sink.

While used in f.e. a MODU [Dissipante 3U](#) (300x 120mm, 0,5K/W) cabinet, the full potential of a CS-80 module can be shown. The module exactly fits, where the PCB fits between the construction L-bars, see picture below with PS-80 power supply. Use a MODU inner pierced base as well if you want to use a L-mounted power supply as well ! A 400mm deep model will fully fit a CS-80 + CD-80 pair at full potential.



## CONNECTOR FUNCTIONS

The bottom connector of our CS-modules are meant to connect a symmetrical power supply to it. CS-80 is standard NOT equipped with some power supply capacitors, but you could mount some close to the power transistors. The possible capacitance will mostly not be enough though to bring this module to full potential. A power supply with some extra capacitor value and rectification has to be connected at the bottom connector. We provide several Power Supply modules with different size, functions and/or different power capacitor banks, which all will fit to this connector. Our [PS-80 range](#) is especially made for CS-80. Matched fix. Of course you also could connect a hardwired or universal power supply here.

The centre connector is where one of our [VS10/20 Voltage Stage modules](#) is connected, L-mounted or sandwiched. This last option sets the total height at a minimum of around 30mm.

**Please note that only a set of a CS and VS module is a working amplifier!**

*NOTE: there are two jumper locations just above the power header connector. These jumpers connect the V+ and V- directly to the VS-module. If a Voltage Regulator module is mounted, this is regulating V+ and V- to a lower voltage which is then lead to the VS- module. Only if a VR-module is mounted: remove both jumpers.*

Besides the needed connections for basic amplifier function, there are also connections for a PTC and the centre contact leads to the idle current potmeter. With later VS-modules you could adjust idle current, f.e. to switch to class A mode automatically when only low power is used or to class B when NO power is used ..... The PTC leads via the header connectors to our Protection module which can be mounted optionally.

At the left and right connectors the speaker leads are to be connected.

Connector signals: Ground, Speaker output, Hexfet drive signal, + or - power voltage and four extra paths for power measurement, done by or protection module (in development).

At these connectors you also can stack an [input/output board](#) where the connectors, extra filtering like better quality input capacitor, etc. can fit. We even have these I/O boards with a classy balanced input.

Also, our [Current Drive module pair CD-80](#) can be connected here, adding an extra pair of power Mosfets.

At the last page we give a block diagram of how our modules are connected.

## HEXFET Add-on

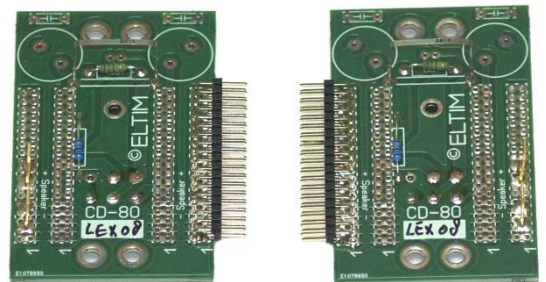
For extra fundament or required power you also can connect an extra Mosfet pair to this CS-80 module to the side connectors. With the extra pair of Power Mosfets mounted on those, this will about double the damping factor as well as the driving current capability.

With this add-on module, the length of the modules will be 300mm, height and depth stays the same. In that case, a 400mm deep MODU cabinet will work fine, leaving 50mm on both side for positioning connectors.

These [CD-80](#) module pairs fits GSD (Mosfets) orientation! We have them with both 8A and 16A EXICON Mosfets.

All side connectors have the same connections as CS-80 has.

It also fits 2x Ø16/18mm power supply capacitors, improving impulse power. For better heat distribution we also recommend to use these while operating in bridge mode.



With these modules attached the total width becomes 300mm, so we recommend a 400mm deep [MODU Dissipante](#), 3U or better 4U height in that case. See also the example at next page where we show a Monoblock setup where a pair of CS-80's are assisted by these CD-80's.

In the graphs above we show the difference in available power with thin lines.

The CD-80 modules are also available now. If you order them together with a CS-80, we deliver both with selected Mosfet pairs without extra charge. Due to this, modules are especially assembled taking about a week before delivery.

## INPUT / OUTPUT add on

In order to make connections required most easy, we also developed special I/O modules for these CS-80 modules. We have boards with a line input and with XLR balanced input, using the unique [InGenius](#) technology by

**THAT** Corporation

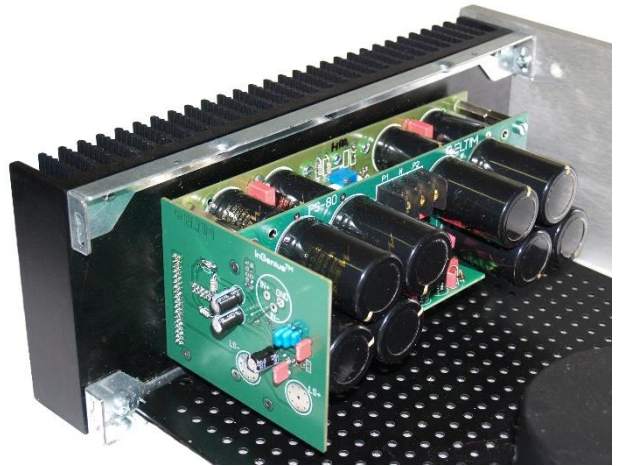
You just need to bring some straight, short wires from this board to the connectors of the back of the amplifier, see the picture at right.

## “Wireless” connecting

At the right the result of a full mounted pack:

CS-80 + VS-20 (not visible) + PS-80(v1) + VR-3 + IO-80bal.

Five modules connected without a centimetre of wire. Just connect a transformer and the in/out connectors with short wires. A nice and clean amplifier setup.



## Protection

If you want to protect your speaker, you need one of our [Protection modules](#). This module detects differences between in- and output signals and acts if this event occurs, f.e. overloading it or if the amp has a fault.

The protection module separates the power supply from the electronics and/or discharges them very fast, instead of a relay with unsuitable nickel/wolfram contacts causing distortion, especially with small signals. This board is mounted on one of our Power Supply boards.

However, the Mosfets we use show NO irregularities as many other Mosfets (easy breakdown) and regular transistors (thermal runaway and oscillations at high power) tend to show.

So far we nor any of our customers experienced breakdown of power Fets in our designs.

## THE MISSING PARTS, or less is more....

While using the Mosfets we do, the schematics can be kept very simple. We don't need to feed the power transistors with a lot of current. Mosfets only require a lowest possible impedance voltage signal.

Also, they show a negative temperature characteristic. Due to this effect we also don't need to take precautions avoiding a so called “thermal runaway” effect as regular transistor based amps tend to show.

In other words: if they become hot, they tend to take less current. Regular transistors will take more, and....

We also don't need rows of Mosfets as seen everywhere and required to keep the Mosfets inside their Safe Operating Area (SOA). The ones we use have no SOA and so you need only one pair for 150-200Wrms.

By using a fully symmetrical design, electrical AND mechanical, there are no DC-irregularities in the output while switching the amp on or off, there is NO speaker “anti- plop” protection needed, mostly a (distorting) relay in the speaker line. With this amp module there is just a tiny “tick”, without any woofer DC shifts when power comes on and about 1,5 secs. some minor distortion when power goes down (@ around 15Vdc) before signal stops, also without slow and far moving around of the woofer cone.

If this short period of distortion disturbs you, take away the input signal with power off or use our protection module, which prevents this event by discharging the power supply fast, instead of a relay in the speaker line.

There is also no output coil in the output line, meant to prevent current peaks. As a matter of fact, especially short impulse peaks make the music more real and this network is killing it..... So, we left this out.

The Fets we use can easily handle these peaks, don't worry.

We did about all possible, 24 hours of clipping them, short circuit (unintentionally of course....), square wave signals @ 2ohms loads, etc.

This coil comes from ancient times where the power transistors (f.e. famous mother of all 2N3055) just barely could handle the power even without serious peak currents..... And still they blew out even while rows of them were mounted. The same counts for older Mosfet based amplifiers giving power Mosfets a bad name.

Finally: In technical terms we use a class A/B setting, meaning that the power Mosfets are set just in their linear range. BUT and unlike about all other transistors/mosfets, from that point on they are working extreme linear. So, despite the fact that you can, there is about NO advantage in aligning them in class-A operation.

[Read more.....](#)

[www.eltim.eu](http://www.eltim.eu)





The input signal is fed into a VS-module, which has to be mounted at the centre connector. See the specific info of the module in question.

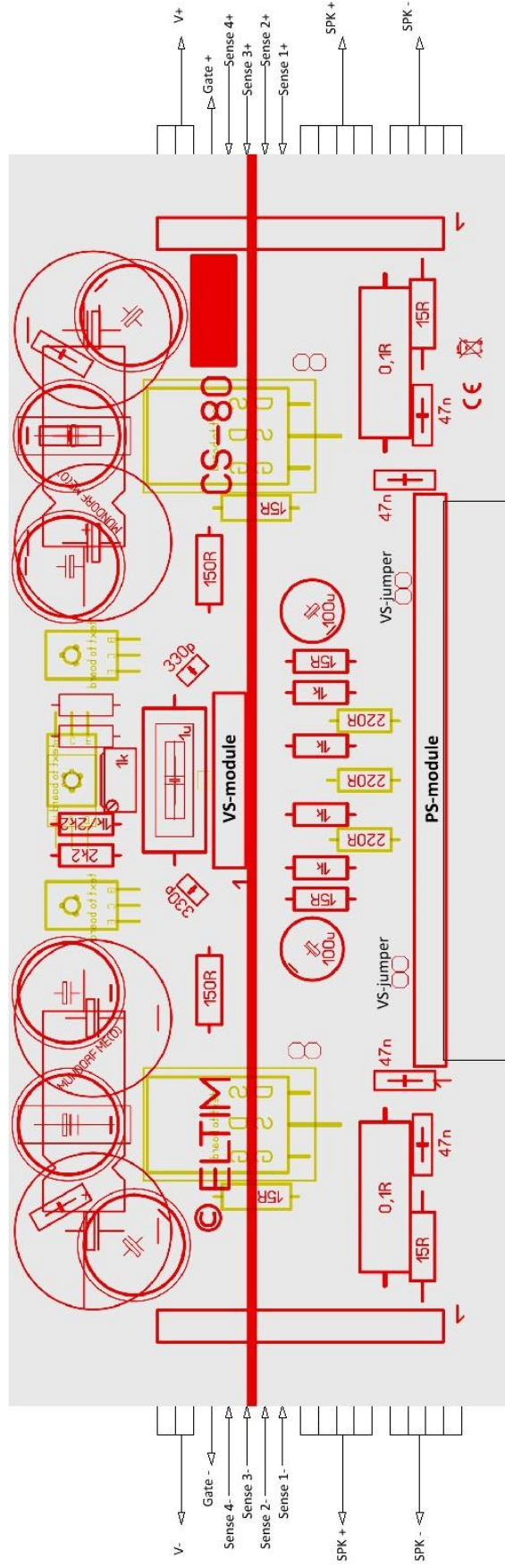
For extra power / improved specs you could add a pair of CD-80 modules left and right. They are fed by the V+ resp. V- lines.

If a Protection Module is mounted on a PS-module, you have to shortcut both jumpers close to the power transistors.

The voltage drop over the power resistors is available at the Sense 1+ resp. Sense 1- lines. Our PR-modules measure this and take action if required.

Two jumpers close to the power Mosfets connect the sense resistors to these sense lines. If you use these lines for other purposes, remove these jumpers

The 2x36 pin horizontal connector leads to one of our Power Supply Modules, like PS-80 which is sandwich mounted onto this CS-80. Together they form a compact power pack.



If no ELTIM PS-module is used:

Connect ALL (20) ground and (2x6) Supply pins, otherwise failures!

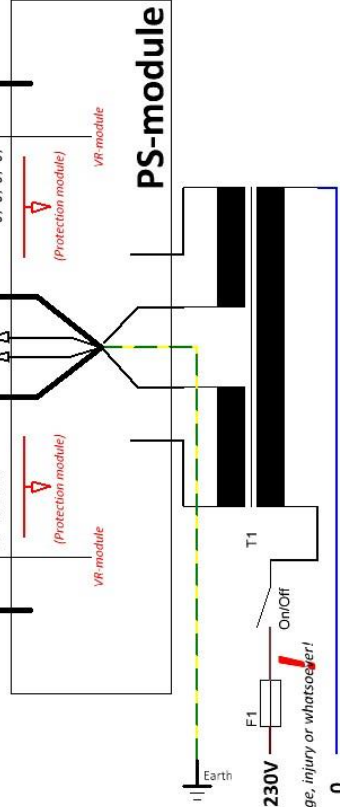
If no Voltage Regulator or Protection Module used:

Mount the two VS-jumpers on CS-80, connecting V +/- to VS +/-

If a Voltage Regulator or Protection Module used:

Remove both VS-jumpers on CS-80.

Then VS-module is supplied by VR-module.



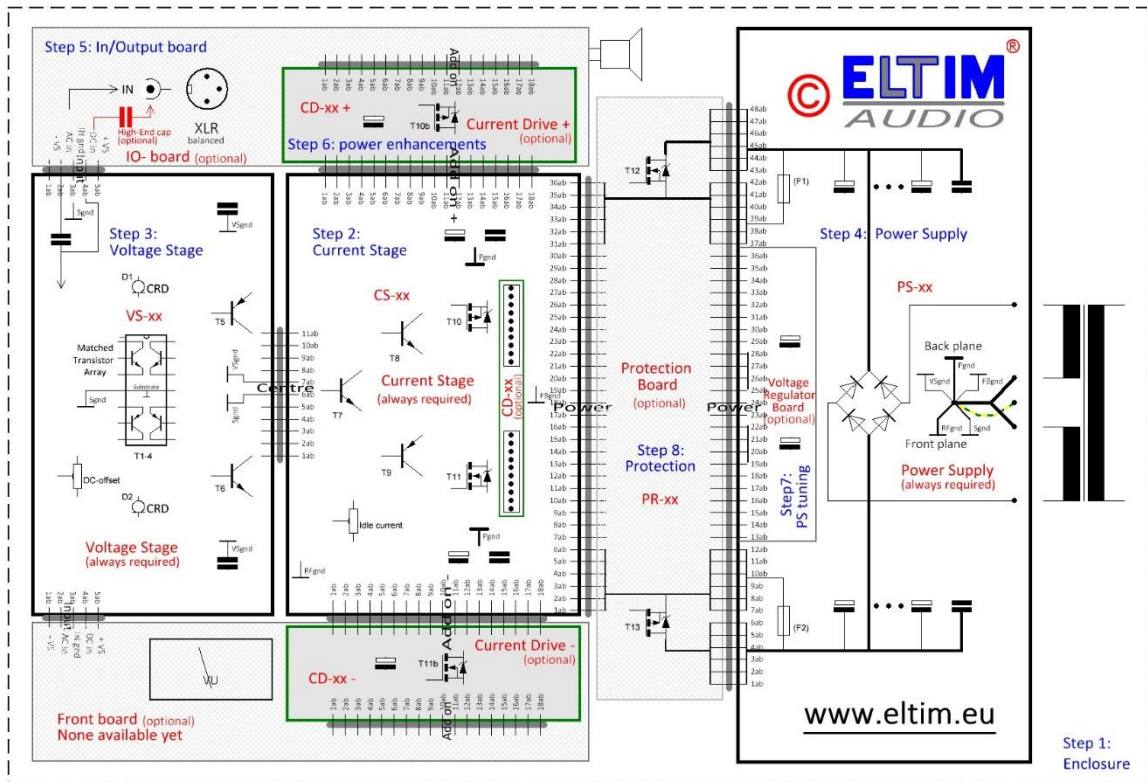
For primary leads connections there are regulations by law you have to follow.

Please act accordingly for safety!

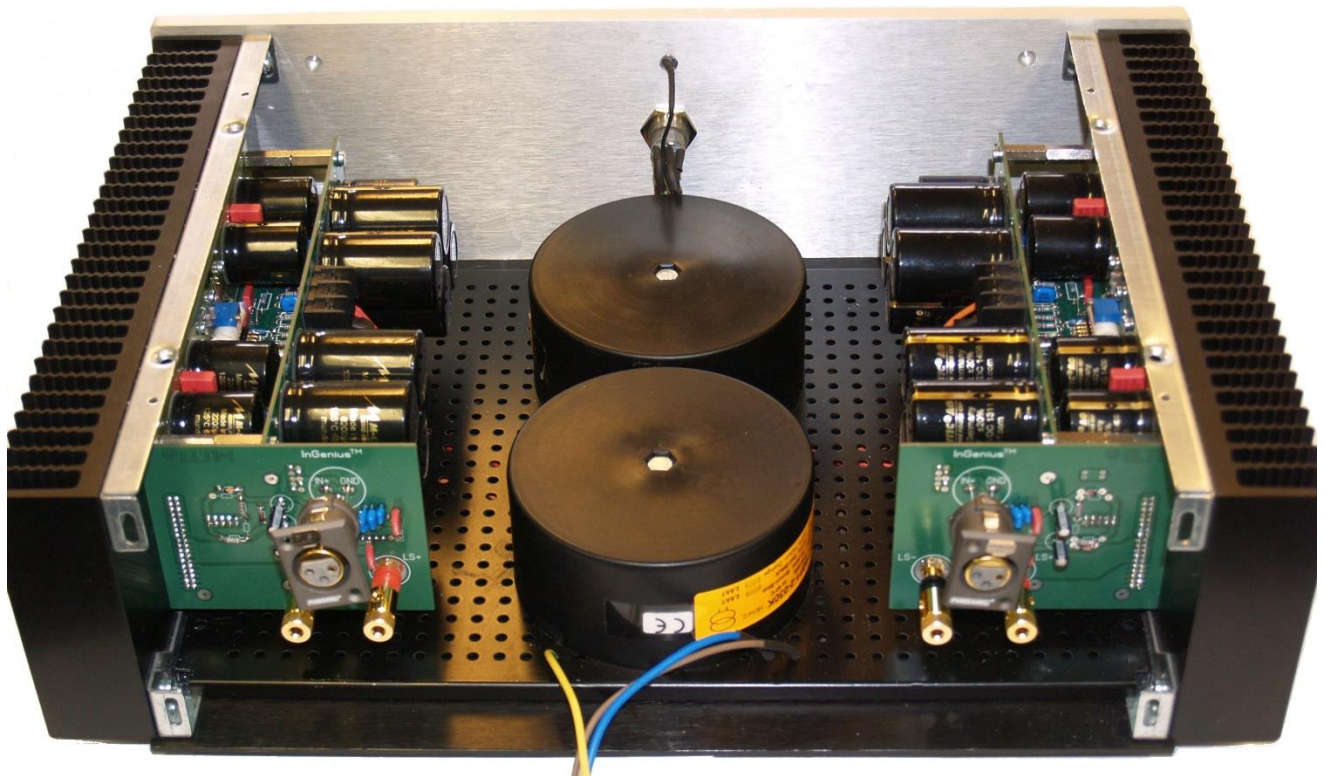
ELTIM audio BV will be not responsible for any damage, injury or whatsoever!

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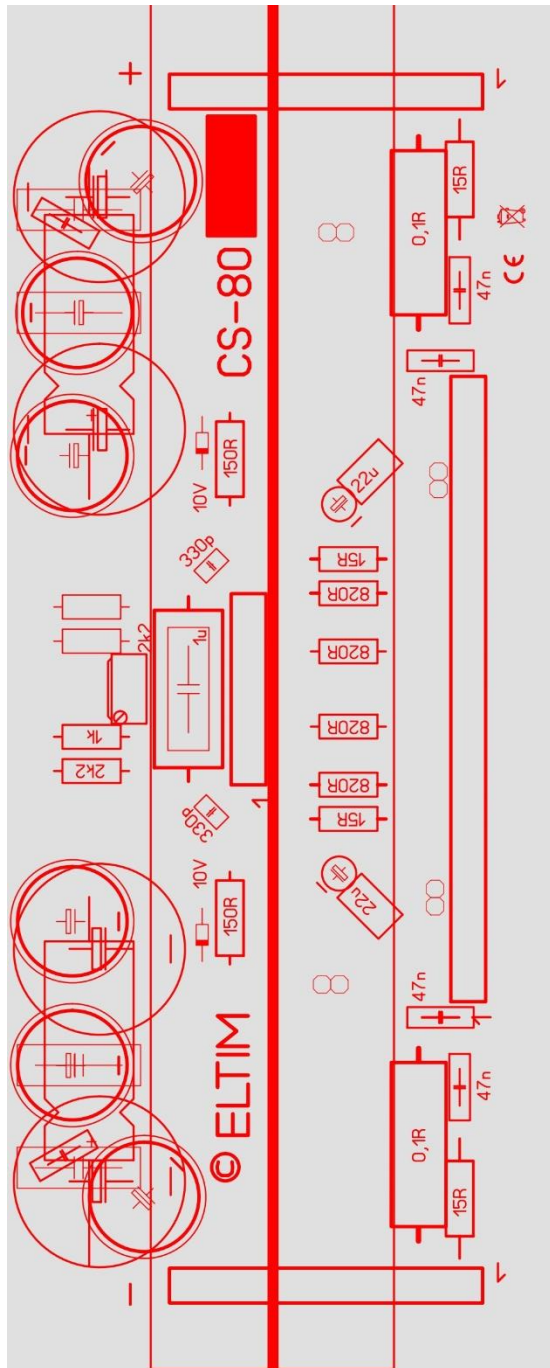
Here our functional layout of our modules program:



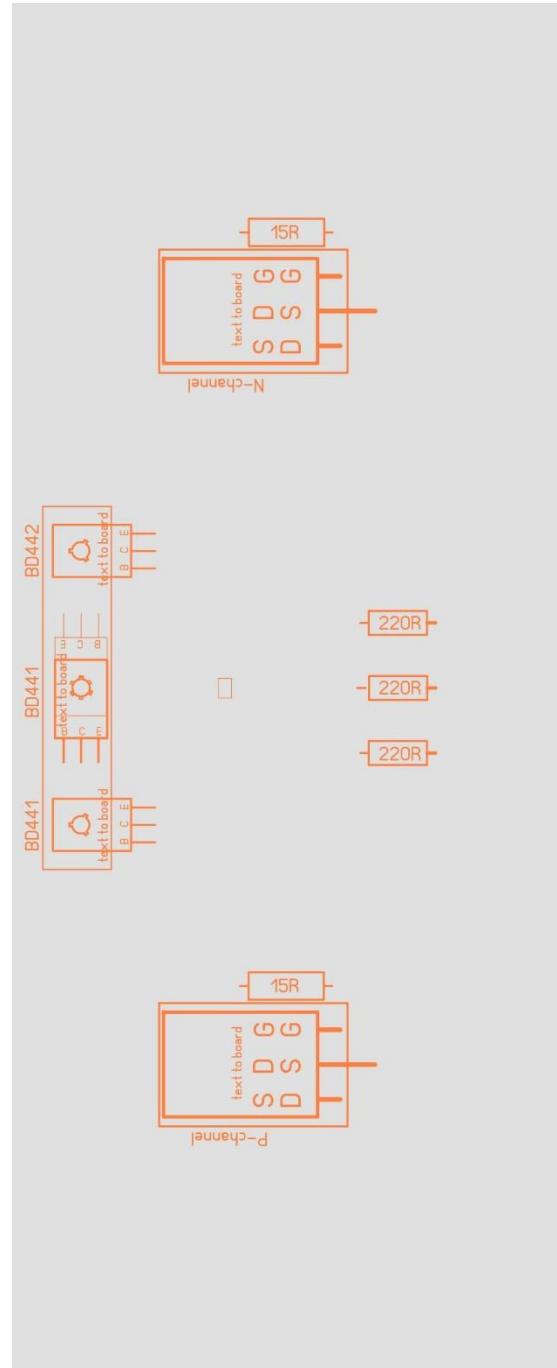
Just define the way you want to build your amp and follow the steps.  
 For a full functioning amplifier you need at least a CS-80xx, a VS-xx and a symmetrical power supply.  
 The grey ones are not necessary, are just an extra for improved functioning / extra options.



At left: CS-80 flat mounted to the heatsink, then L-mounted to CS-80 a VS-20L, then a PS-80 power supply module.  
 On this PS-80 also fits a VR-xx Voltage regulator module or a protection module.  
 At the back end is an IO-80bal in/output module with an Ingenius™ balanced input by THAT Corp.  
 Right side is the same, only mirrored. Only wiring is the transformer(s) wiring, so this amp works !



Front side view  
- at left, + at right side



Back side true view  
so + at left, - at right  
And yes, unlike most other Mosfet designs  
the P-Fet is at the positive side!

### Demo video

While powering up and testing our new (Febr. 2021), huge CS-150 module with three pairs of Mosfets, assisted by an extra pair on the CD-75 add-on module we [made a video](#) of this testing. Some results, proven in this video:

*DC-170kHz ±0,2dB, -3dB @ 470kHz, slew rate 67V/us.* We believe these are fantastic figures.

While using different schematics our amps can be way more simple and symmetrical, also solving some other issues, resulting in an amazing open and “airy” sound as noticed [by many, even competing professionals](#).

After six years of operation it’s now called “the ELTIM sound”. Nice -)

Our amps show a tube like sound, but with way more and rock solid bass, finest detailed highs, fantastic 3D, a super wide frequency range and an amazing speaker control.

We make *MUSIC* again, not just **power** under the slogan “**LESS IS MORE!**”