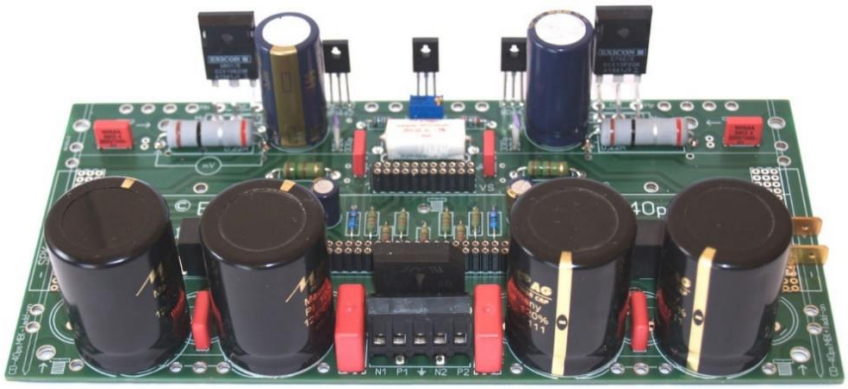
Updated October 17th, 2023

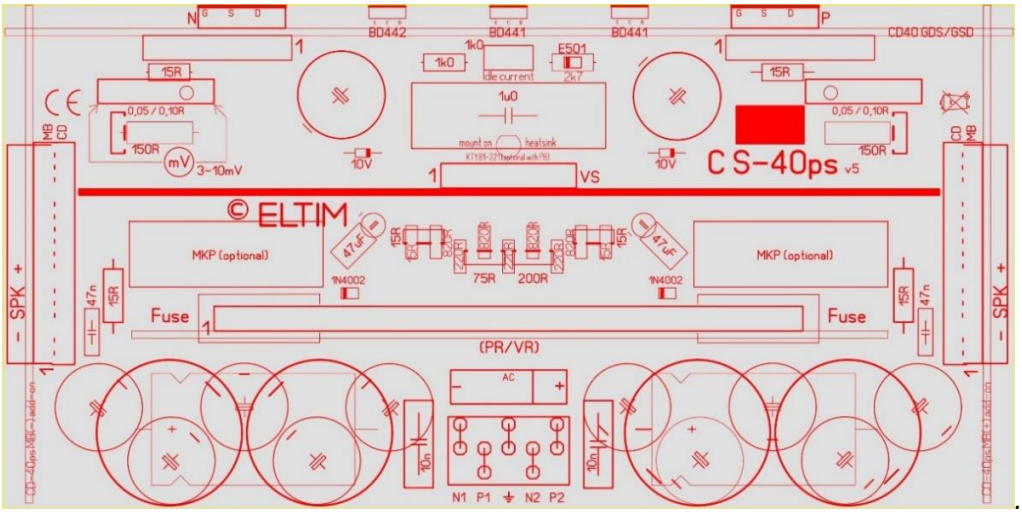
CS-40ps v5 Current Stage module with power supply

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 our 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.

To make a true difference, we split our power amplifier schematics in a voltage- and a current stage board to obtain the maximum possible sound quality and at the same time a most simple and logic PCB layout. 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 speaker currents. This cooperation works very well indeed as many indicated as a "tube like" sound yet where a rock solid, deep bass response is added.
While using large and extremely linear functioning EXICON 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+ PCBs made by a highly regarded European manufacturer, double sided (2x35um), tinned isles, text on both sides, etc.
On this CS-40ps module we also integrated a symmetrical power supply. Just connect a transformer.



CS-40ps v4



V5 changes: *also space for 12x Ø18mm elco's or 2x axial, current measuring MR5 resistors replaced by special BOURNS current sense resistors, about all MOX resistors can be replaced by (rel. expensive) induction free TO220 types, f.e. CADDOCK, two significant sized MKP capacitors can be mounted over the power rails, side connectors modified for small monoblocks, added two headers at top for 2-4 pairs Mosfets, etc.*

The basic built module is L-mounted to a heatsink, as most amplifier modules are.

Instead of power Fets mounted on this CS-40ps, you now could decide to use our CD-40 MB modules instead. On those boards a pair the Mosfets are located on side mounted PCB's and make a very nice Monoblock, exactly fitting in Modu Galaxy cabinets:

We made a YouTube video where we demonstrate this module (incl. VS-20!) to one of our professional customers. You won't hear on your PC/SmartPhone what we heard, but you can compare it with similar videos.

This **CS-40ps** v5 power (current) stage PCB highlights:

- Positions for GSD (mostly Mosfets) oriented types, TO-247 or TO-264. We use EXICON
- Headers for special Monoblock CD modules see picture:
- Integrated, symmetrical power supply with sufficient space for serious supply capacitors for >200Wrms power.
- Multiple positions power supply capacitor bank:
  - 2x Ø28x54mm axial capacitors for low-cost purposes.
  - 2x5 Ø16/18mm, pitch 7,5mm low profile or high/audio grade radial capacitors.
  - 2x2 Ø30mm, pitch 10mm, low ESR, classy or high value capacitors.
- Quality MKP capacitor in the idle current network.
- Current driven feedback in the centre of PCB with multiple paralleled resistors, reducing noise.
- All significant standard MOX resistors can be replaced by induction free TO126 or TO220 types
- Speaker output both left and right.
- No 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.
- 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 commonly used (1A) headers.
- Speaker signal for signalling/protection purposes at all connectors.
- Input signal available at main central connector for protection electronics.
- PCB position to mount an NTC/PTC at centre, connected to both horizontal connectors. Will be connected to a Protection module if mounted.
- Dimensions: 209x104mm. Effective height depends on Fets/power capacitors used.
- Highly efficient at average/low power due to low idle current, way better than class-D at low levels.

Schematically all our CS-modules are the same, except for the types/numbers of Power Fets, supply capacitors and PCB layout. Due to the specifications of the power transistors and capacitors max. voltage, the "figures" their data and pricing is different and based on the max. voltage/current they can handle while mounted in an optimal way.

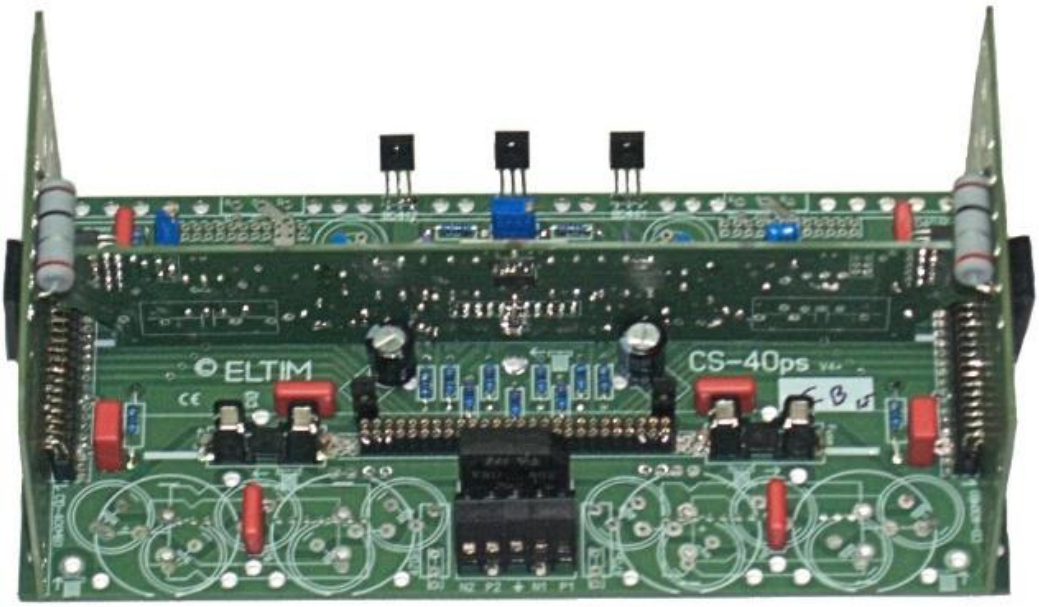
Integrated Power Supply

The schematics and PCB layout of a CS-40ps is the same as a CS-40, but on a CS-40ps PCB there is also a rectifier and space for different sizes/qualities of supply capacitors, together forming a basic symmetrical supply. With the correct capacitor values, it can deliver > 200Wrms speaker power.

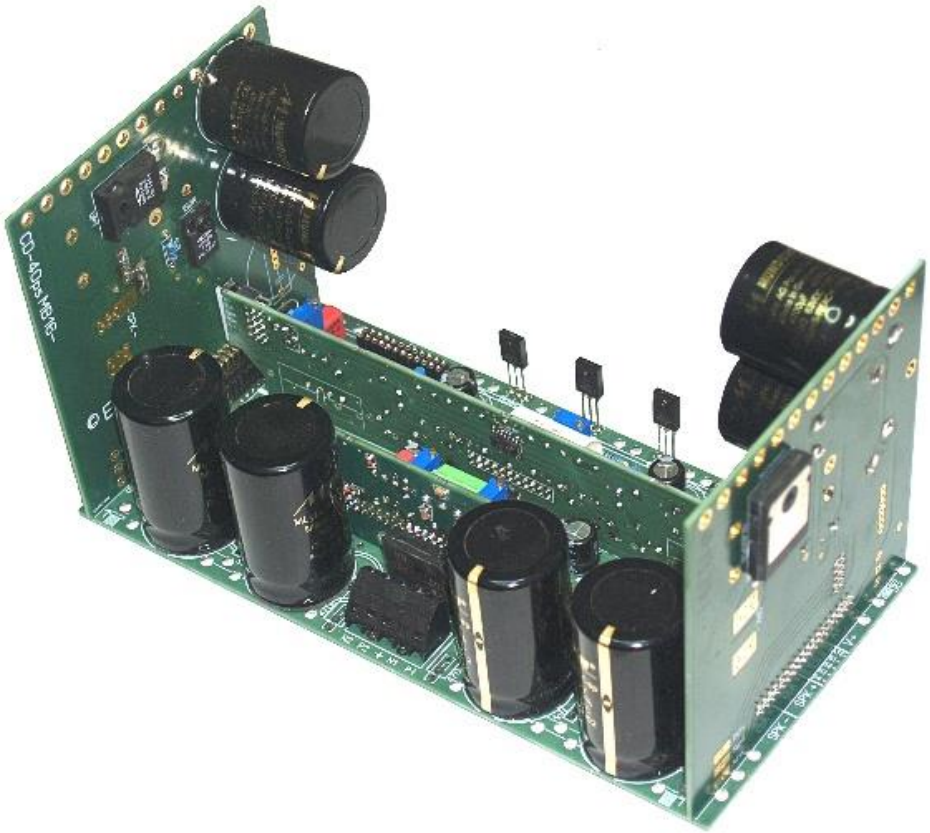
CS-40ps MB version

We also made a special version where no power Mosfets are mounted. Instead, there are header connectors to mount a pair of CD-40 MB modules at both sides.

This combination exactly fits between the profiled aluminium flanks of a MODU Galaxy 230mm wide cabinet.

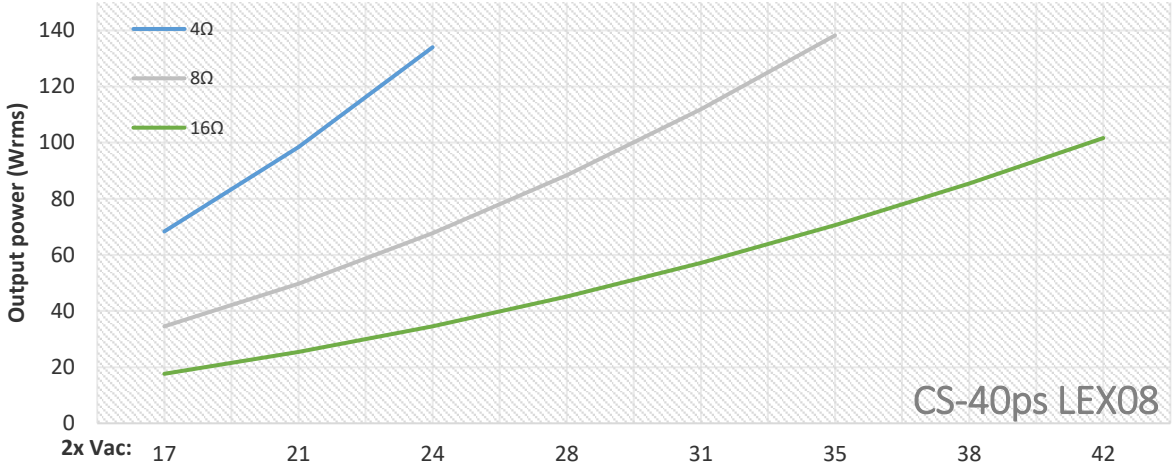


CD-40ps MB LEX 08 with 8A Mosfets, height 80mm. CS-40ps, CD40 LEX08 pair, VS-20
Monoblock output power aprox. 100-150Wrms depending on supply voltage only.
No supply capacitors mounted to show you the PCB layouts.
In the open header connector, a VR3-30 voltage regulator can be mounted (required for supplies >±30Vdc).



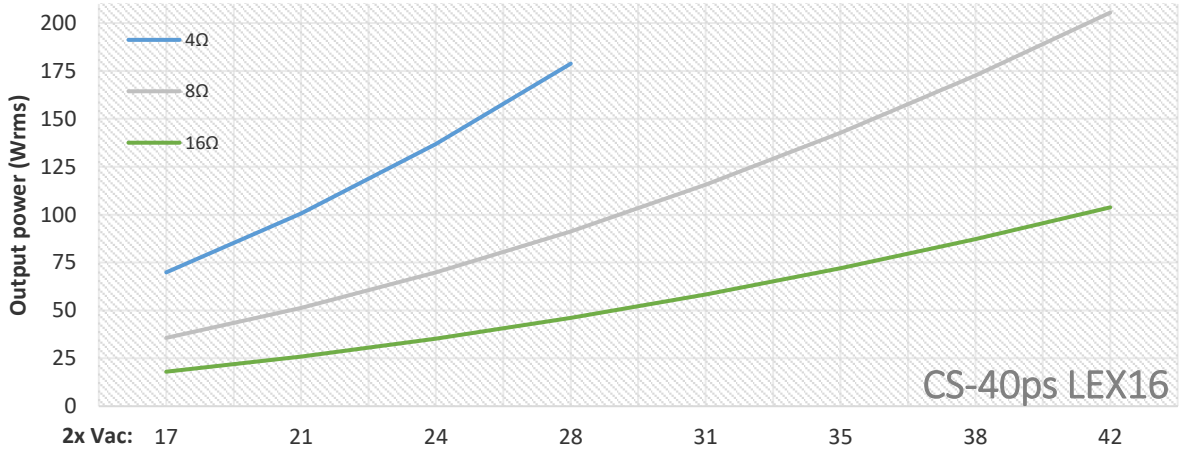
CD-40ps MB LEX 16 with 16A Mosfets, height 120mm. CS-40ps, CD40 LEX16 pair, VS-20, VR3-30
Monoblock output power aprox. 120-200Wrms depending on supply voltage only.

Output power for models with audiophile EXICON lateral Mosfets:



CS-40ps 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!



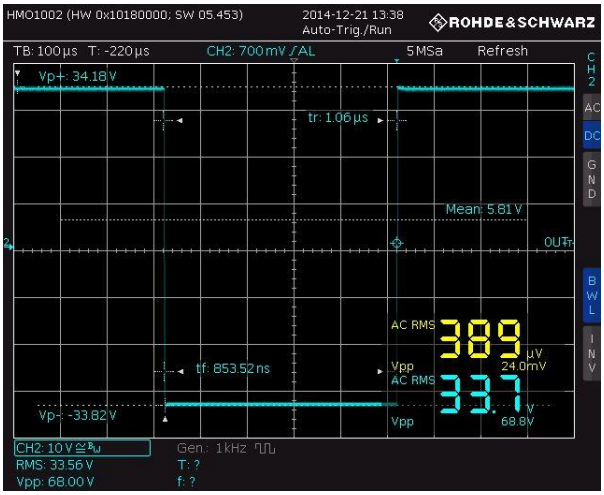
CS-40ps LEX16, *with EXICON 16A/200V/250W, TO-264 lateral Mosfets* (ECW20N20 / ECW20P20)

The power is limited to around 180Wrms due to the size of the PCB tracks and integrated power supply capability.

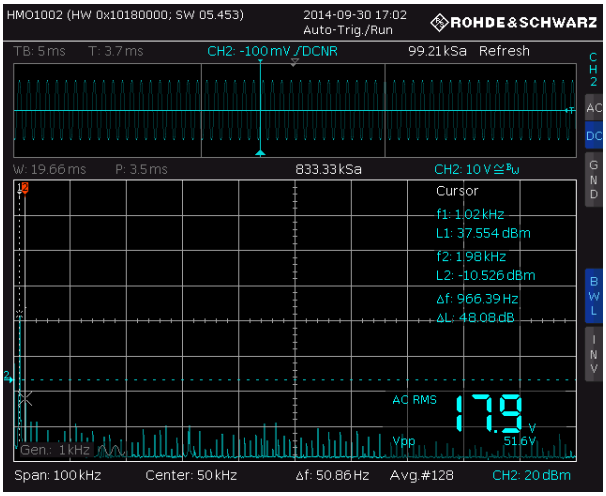
Technical specifications:

Frequency range:	DC - >180kHz within 0,2dB
-3dB point:	> 450kHz
In-out phase shift:	<0,5º (20-16000Hz),-3º@20kHz
Distortion figure (THD):	< 0,001% (1W/1kHz/8ohm)
	< 0,002% (80W/1kHz/8ohm)
Slew rate:	> 65V/uS (@ +/- 30V). Limited by AC-input filter on VS-module used.
Harmonics:	<< -60dB, nonspecific, see graph right below. Ignorable.
Damping factor:	> 200 (strongly depending on power Mosfets and supply capacitors used)
Input voltage:	1 Volt
Input impedance:	47kOhm
Output load:	depending on model and supplied voltages, see graphs.
Supply voltage:	Dual secondary transformer, depending on the model, see graphs.
Output power:	depending on the model and supplied voltages, see graphs.
Dimensions:	209x104mm, height depends on type of supply capacitors used.

Some measurement data

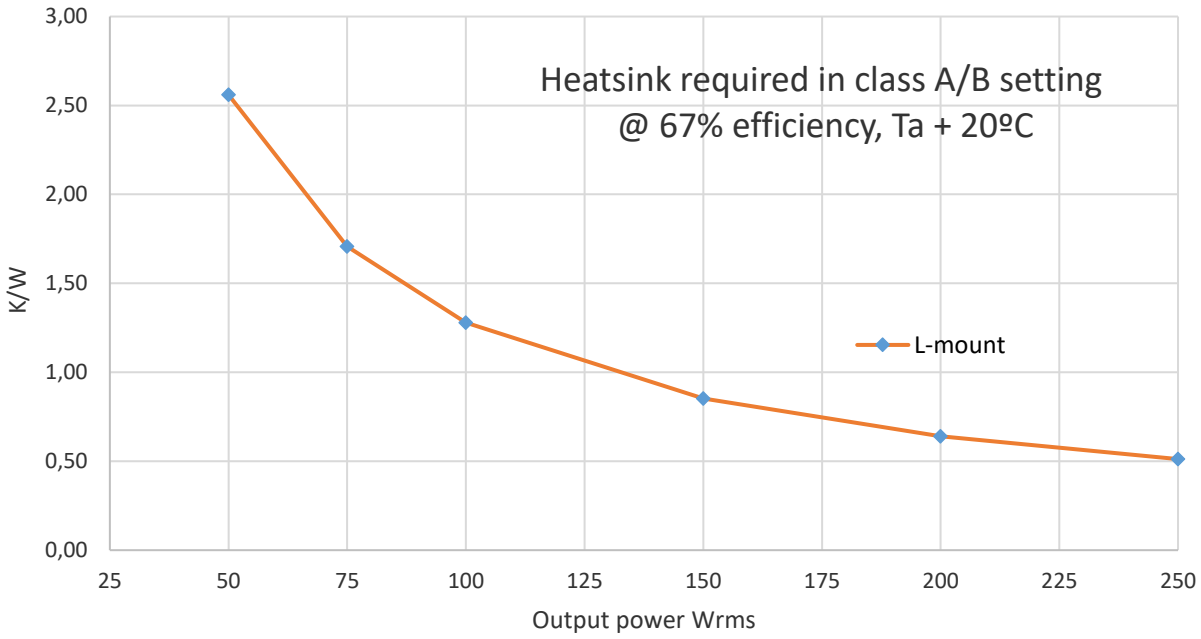


Square wave signal without ANY irregularities
It also shows a slew rate of around 60V/uS.
Limiting factor is the low-pass network in the input circuit!



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



CONNECTOR FUNCTIONS

The 5-pole screw connector is where the two secondary windings of a suitable transformer is connected.
The bottom header connector on our CS-40ps modules is where one of our Voltage regulator modules can be mounted, feeding regulated voltages to the VS-input stage only. IF a VS-module is used you must cut away the two 1N4002 diodes just above this connector! Left and right there are two fuse holders.
While mounting our Protection Module here, the fuses must be removed, and additional headers mounted. Then, the Protection module takes over the function of the fuses, but in a way more complex manner.

We split up a power amplifier schematic into a Voltage Stage (input, small voltages) and a Current Stage (output, large currents) to get the significantly different results compared to all the rest.
The centre connector is where one of our VS-5/VS10/20 Voltage Stage modules is connected, L-mounted or sandwiched. This last option makes the pack a compact version of around 30mm in height.
Please note that only a set of a CS and VS module is a working amplifier! So, you need both.
An INac and INdc input is available on every VS-xx input stage module.

Besides the needed VS-connections for basic amplifier function, there are also connections for a PTC and the centre contact is leading to the idle current potmeter. Future electronics could take the volume down if all becomes too hot and/or lower/increase the idle current depending on the input signal present.
The PTC also leads via the bottom header connector to our optional Protection module.

At the left and right connectors, the speaker leads are to be connected. Max. load/pin 3A (normally 1A!), but we use ten of them, so total 30A. Chinese use cheap 10A screw terminals, connected to 4 pairs (64A) MF's.
Connector signals (pins): Power/speaker ground (10), Speaker output (10), Hexfet drive signal (2), + or - power voltage for CD modules (6) and four paths (each 2) for power measurement / protection purposes.
At these connectors you can connect a pair of our Current Drive modules CD-40ps.

Protection
First, we delivered a variety of our modules all over the world and use them ourselves for years already.
None of them ever broke down as far as we are aware of, not even under short term 2ohms loads under test.
If you want to protect your speaker, you need one of our Protection modules. It is in development stage.
This module detects differences between in- and output signals (distortion, errors), overload, broken Mosfets (all max. 8), over temperature of interior and heatsinks, missing supply and acts if one or more of these events occurs, f.e. overloading it or if the amp has a fault. It even supplies a variable fan voltage.
LED's for overload, over temperature, distortion and one summing all three indications.
The protection module separates the integrated power supply from the electronics instead of a relay with unsuitable nickel/wolfram contacts causing distortion, especially with small signals. We often wonder why just the speaker is disconnected if an amp has a fault. We take power down instead, which seems more logical.

The Mosfets we use show NO irregularities as many other Mosfets (easy breakdown and oscillations while overloaded) 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.

Actually, we only recommend using this protection modules if you use very expensive speakers.
Of course, and as stated in our general terms, ELTIM cannot be held accountable for any damage.

DIY remarks
Unfortunately, we found out that to many DIYers overestimate themselves and fail to complete their DIY project. The unfinished projects sent to us about all show bad soldering's, misplaced components, etc.
After correcting these errors, all modules were working as they supposed to do.

Even though there are hundreds properly working and highly regarded ELTIM modules around the world today, some talk about "poorly functioning modules" on fora, in reviews, etc. without telling or even realising perhaps they made mistakes themselves.
Unfortunately, in their "wisdom of truth" these people are harming our and our products good name and the DIY community itself. A pity, the more because they most probably don't even realise that or don't care.

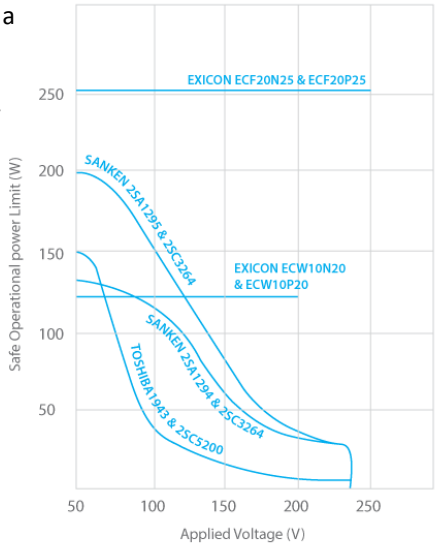
We decided to drop this DIY delivery and only sell properly soldered, tested and very well-functioning High-End ELTIM built modules now.

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 and 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. 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 need only one pair. 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, actually 3-5x more than the supply chain can deliver, so the fuses will blow way before the Mosfets do. We did about all possible, 24 hours of clipping them, 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 in recent past. Their bad “SOA” behaviour also made it necessary to mount multiple pairs instead of just one pair as we use.
The graph at right shows a comparison with famous ones, as many still use today.
This graph comes from Exicon.



LISTENING (yes, not measuring over and over, 5 figures behind the comma….)
We listen to the CS-40ps (MB) module for a real long time in our own living room now and simply forget that it’s there. We use it as anyone else would do, listening to music, watch the news, series and movies. Unlike our Accuphase P-450 there are NO irregularities, especially noticed with spoken voices. The bass fundament is simply fantastic and correct and makes you smile at first bass note/drum, especially while looking at the simple setup. The “air” around voices and instruments is amazingly beautiful……. Cymbals singgggggggg as they always should do. Not Tsshhh, etc. as heard so often.
Even non-audiophile visitors get tears in their eyes ! Actually, we don’t use our P-450 (€ 10k) any more, at this moment (Jan. 2019), replaced it by a pair of compact 8A monoblocks. One Accuphase Class-A adept noticed the P-450 needles waving “Accuphase really does sound nice” he said. Yes, but our small monoblocks were driving the speakers -)
Most of you probably won’t believe that this already sounds better than our highly regarded P-450.
Our experiences are confirmed by several true audiophile listeners. They all are amazed about the natural sound and fantastic 3D presentation. The “air” around voices and instruments amazes all, incl. us -)
We also got some replies mentioning that the bass is deep and very well under control.
Some confirmed that it sounds better than the high-end stuff (even expensive, regarded brands) they use…….
One word came up more than once: EMOTIONAL. Just as we wanted it and always should be.

Right, marketing bla, bla. NO its not, we are audiophile technicians hating this bla, bla as you do.
Since DIY’ers often want to see (instead of listening), the measured results of our ideas and efforts can be, this is demonstrated in a video. We have more, just search for ELTIM on YouTube.

More specific info of every separate module you can find at our website.

CABINET tips

Since ELTIM audio BV also represents Italian MODU cabinets our designs were adjusted in size to these cabinet dimensions. This way, we get remarkable High-End cabinet looks a s well. Some idea's where this CS-40ps fits:

- All MODU Pesante (Dissipante) models, leaving room for one or even two max. Ø150mm toroidal transformer(s).
  See the picture at right (MODU 1NPD02300):

  This picture shows our DEMO amp by the way >

- All MODU Slimline models leaving room for one or even two max. Ø150mm toroidal transformer(s).
  For low/medium power (50-100Wrms) as shown at left in a 60Wrms version, the profiled sides can be used as cooling surface, otherwise you need separate heatsinks.

- MODU Galaxy Maggiorato 230x280mm,
  in a nice and compact MONOBLOCK configuration.

  Here: CS-40ps CB + CD-40ps MB LEX08 + VS-20
  in a Galaxy 230 x 280 x 80mm cabinet. 150Wrms.
  You also could build a 200W version in a 120mm high enclosure while using CD-40ps MB LEX16 modules.

  These are the monoblocks we use our self every day > > > > > >

- MODU Galaxy 124x230x40mm in an extremely small size.

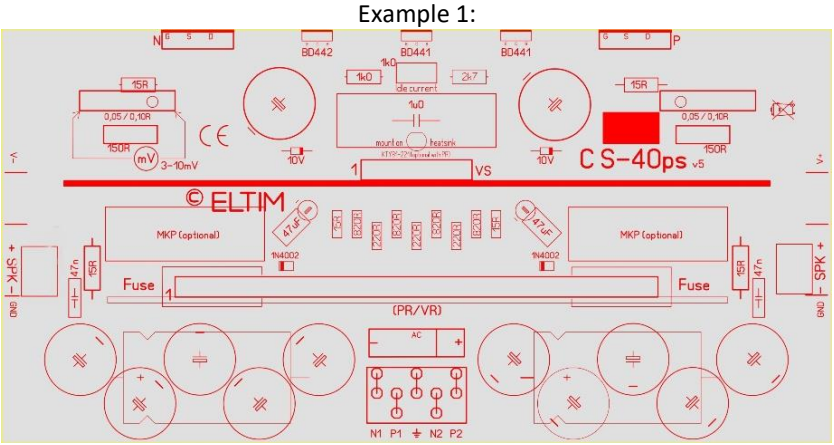
The cooling surface is obviously too small here and a 40x40mm cooling fan just fits as well. Use 10x Ø18mm caps with low height and mount a VS-xxS version which is sandwich mounted to CS-40ps.
A 80mm high cabinet gives more space and VS-xxL as well as larger sized capacitors can find their space required.

Make (extra) holes in the cabinet to let the hot air out!
The transformer needs to be mounted elsewhere.

While exchanging the front panel with a larger one
(make it yourself), you could mount it in the back of a speaker!

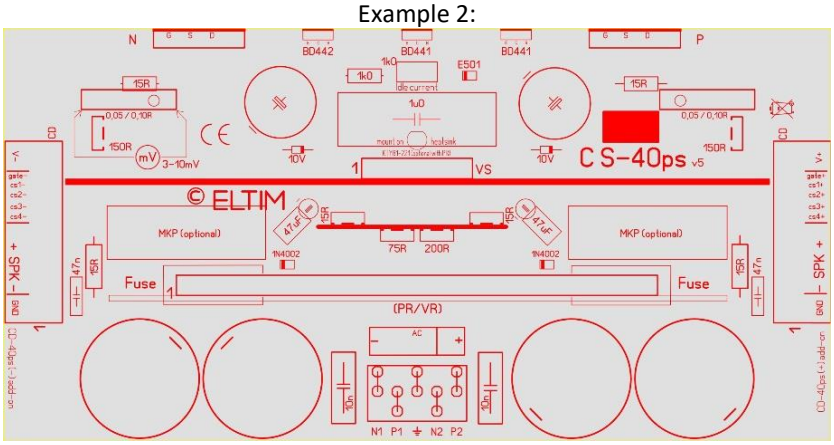
Possible layouts:

Example 1:



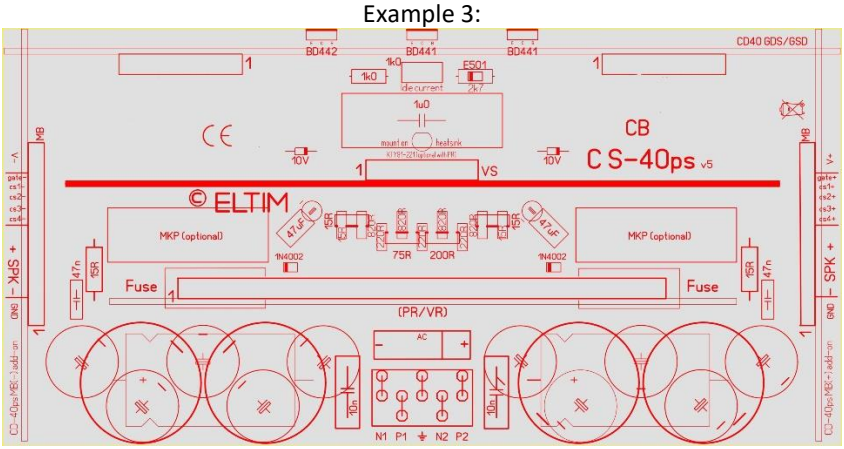
CS-40ps v5 LEX08 with as example axial or radial Ø18mm supply capacitors, all 1% MOX resistors and speaker screw terminals at left and right, 20A, pitch 7,5mm. 8A/200V Mosfets shown.
You could connect extra chassis mounted capacitors at left and right.

Example 2:



CS-40ps LEX16 with as example Ø30mm radial capacitors + small 15/22,5mm caps over the voltage lines, all 1% TO220 induction free thick film resistors + Current Regulator Diode in the idle circuit (more stable) and angled side headers for connecting optional CD-modules with an extra pair of Mosfets.

Example 3:



CS-40ps CB with all component locations (as printed on the board) shown. There are <u>no Mosfets</u> mounted on this version.
This CB version is meant to connect a pair of CD-40 MB modules left and right for small Monoblock structures or for a small up to a very large Mosfet/Hexfet module where 2 – 4 pairs are mounted, capable of making > 500Wrms (= supply restricted, 8A rectifier).

With >200Wrms output power we recommend using some chassis mounted supply capacitors as well.
Most options above can be mixed at random if they don't use each other's space/same function.
In all cases extra and quite large MKP capacitors (over voltage rails) can be mounted at the centre of the board.
Possible options/combinations will be listed with the article in our webshop. All will be clear then -)

This CS-40ps module has to be completed with a VS-5, VS-10 or VS-20 Voltage Stage (input) module to make it work.
To complete the power supply part you also need a suitable dual secondary windings transformer. *VA = 1,3 * Pout.*

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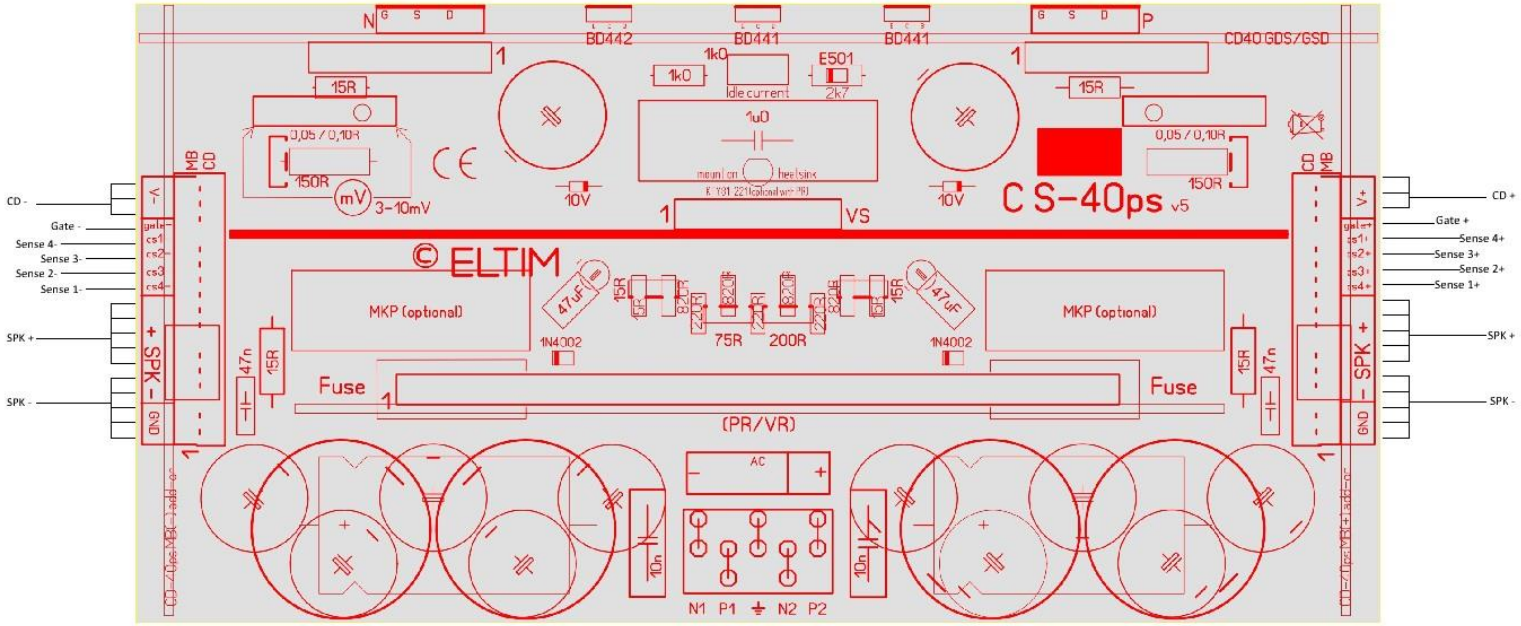
In a basic configuration you just mount a VS-module to the centre connector and the speaker leads left or right of the board.
The input signal is fed into the VS-model used, see the specific info of the module in question. The VS-module can be sandwich- or L-mounted.

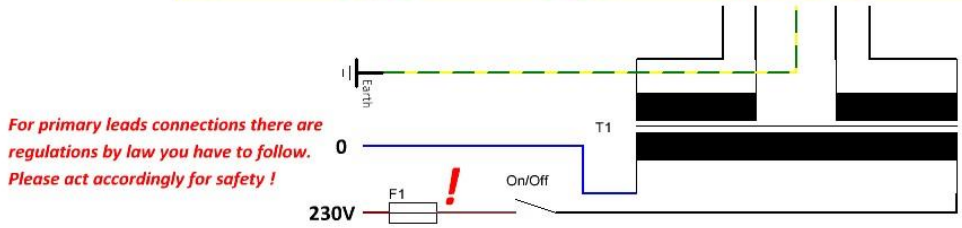
For extra power / improved specs you could add a pair of CD-40ps modules left and right. They are fed by the CD+ resp. CD- lines.
After mounting these CD-modules, all connections stay the same; the total just becomes some wider, see the data of the CD-modules used.

If a Voltage Regulator board is mounted at the large horizontal connector, you have to remove the diodes just above this connector in order to feed the VS-module with the regulated voltages.

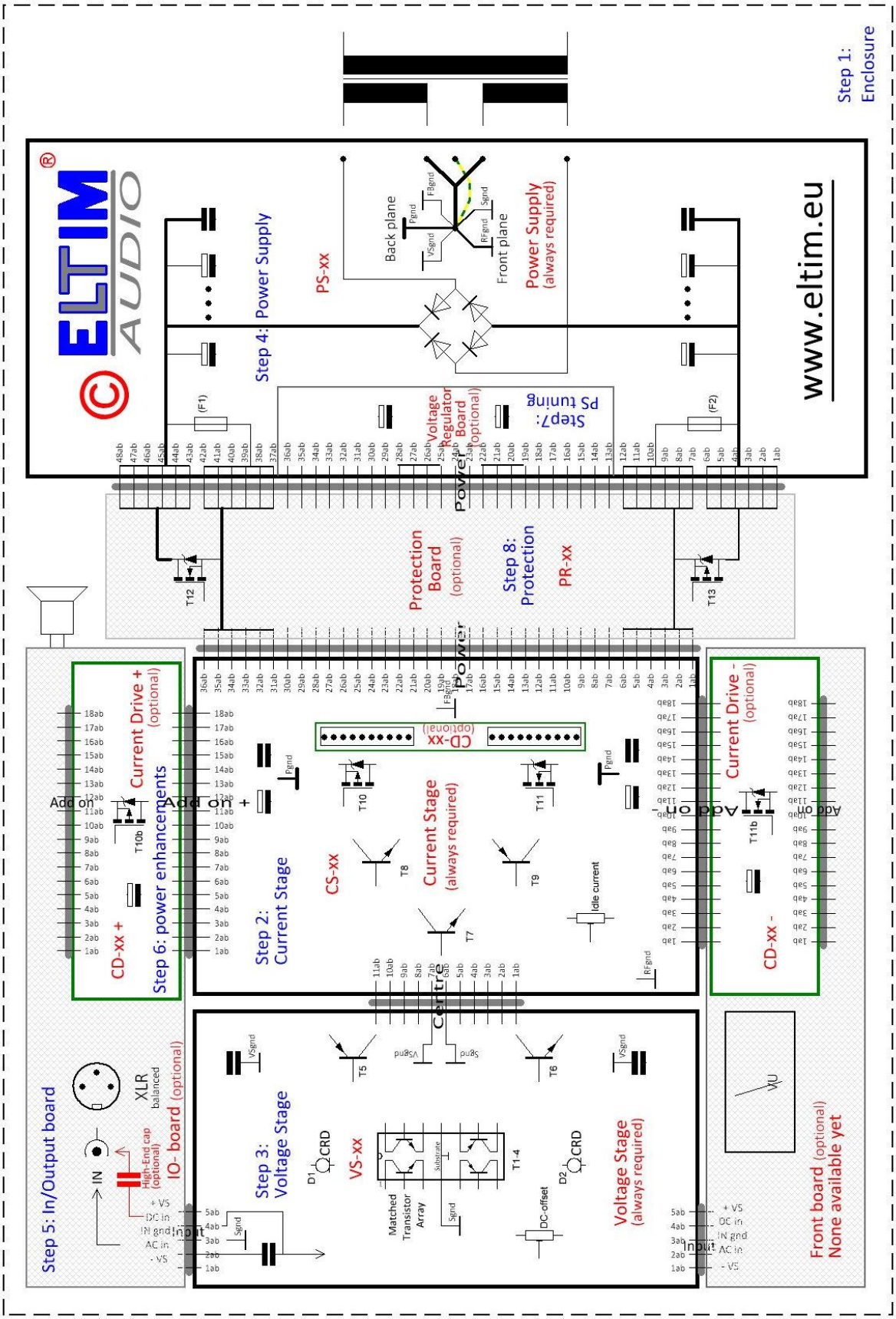
If a Protection module is mounted to the large horizontal connector, you have to remove both fuseholders and insert extra header connections.
In that case, the voltage drop (read: current flow) over the current sense resistors (Sense1+ resp. Sense 1- lines) are interpreted. Our PR-modules detect all kinds of faults and take action if required.

Use a double secondary winding transformer (VA=1,3 * Pmax.) and connect it to the bottom screw terminal as in the schematics below. DONT't FORGET TO USE A FUSE WITH THE CORRECT VALUE !
Also take all precaustions given in different legal documents about primary connections. We do NOT accept any legal actions or claims. It is YOUR responsibility to prevent any damage or injuries.





For primary leads connections there are regulations by law you have to follow. Please act accordingly for safety !



ELTIM High-End modular amplifiers layout

On this CS-40ps the Power Supply and Current Stage are on a single board. A protection module can be mounted on top of that, via a header connector where all the pinning is the same as shown here.