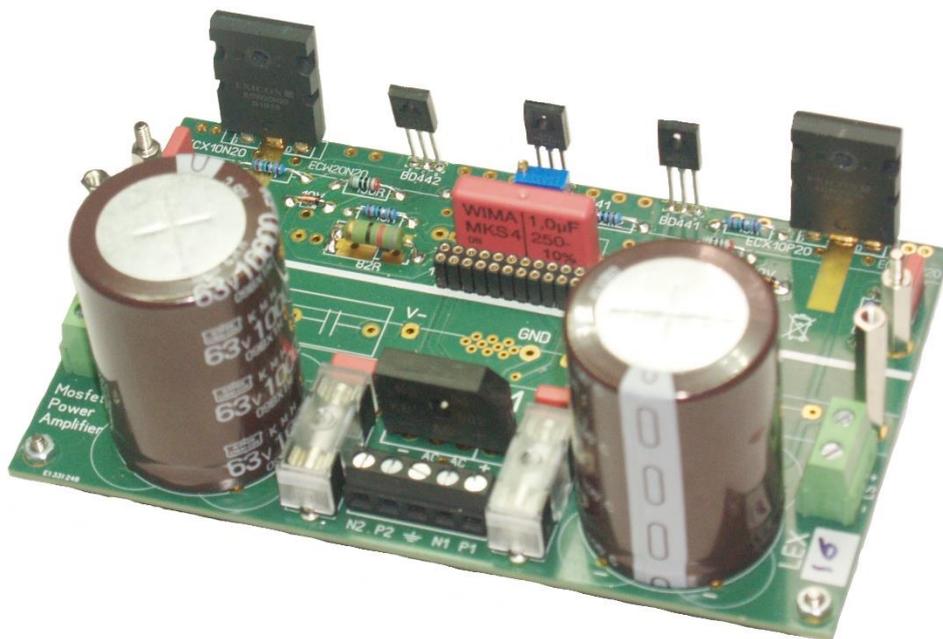


CS-35ps Current Stage module with power supply

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.

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, added with solid bass. 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. On this CS-35ps module we also integrated a symmetrical power supply. Just connect a transformer.



Example of a CS-35ps LEX16 with integrated power supply.

This CS-35ps module can be sandwiched with a CS-35 module, than sharing the same power supply of CS-35ps. While leaving out the central screw connector on CS-35, the V-, GND and V+ connections can be fed through the PCB to the matching locations on the CS-35ps module (marked), forming it a nice and compact stereo, multichannel, active speaker or bridged mode powertrain.

Only three straight and solid copper rods 1,5mm² make the supply connections. Nice, compact and clean. While sandwiching both (or more), you still can use long, high capacitance supply capacitors!

For ultra-compact solutions you even can sandwich mount our [matching VS-5](#) input stage modules.

This **CS-35ps** power (current) stage PCB highlights:

- Versions for GSD (mostly Mosfets) and GDS (mostly Hexfets) oriented types, TO-247 or TO-263.
- Integrated, symmetrical power supply with sufficient space for serious supply capacitors.
- 8A/140Vac rectifier, can be cooled by 2x finger/IC coolers while highly loaded.
- 2x 4 \varnothing 18mm, pitch 7,5mm or 2x \varnothing 30/35mm, pitch 10mm electrolytic supply capacitors fit.
- With a mounted CS-35 on top you still can use any length of supply capacitors.
- 2x serious quality MKP capacitors over the voltage rails (option).
- WIMA MKS4 1,0uF in the idle current network. Quality MKP capacitor optional.
- Current driven feedback in the centre of PCB by 2W or 3W MOX resistors (induction free SMD optional).
- Speaker output available both left and right (20A, pitch 7,5mm, 4mm² cable) .
- No coil in the output line resulting in a way better impulse behaviour (>40V/us @ \pm 30Vdc).
- Separate tracks for Power-, VS-stage and input ground.
- All grounds are leading to the centre front area of the PCB.
- Wide (>8mm) and thick (35um) speaker-, ground- and power rails tracks.
- High efficient at average/low power due to low idle current, actually way better than class-D at low levels.
- CS-35 (without power supply) can be sandwiched for stereo, multichannel (active!) or bridged operation.
- Width matching our new and [compact VS-5 input module](#), also mountable as sandwich for lowest height.
- Size 149x90mm. Effective height depends on Fets and power supply capacitors used.

Basically all our CS-35ps modules are the same, except for the types of Power Fets and supply caps mounted. 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 symmetrical Power Supply

The schematics and PCB layout of this CS-35ps is exactly the same as a CS-35, but on this CS-35ps PCB there is a 8A/140Vac rectifier and space for electrolytic supply capacitors, together forming a basic symmetrical power supply with a max. capacity of around 200Wrms total output. At high loads use finger/IC coolers!

Instead of the central screw terminal on CS-35 (not installed, but supplied) you can feed through 3x 1,5mm² copper rods to the power supply part of a CS-35ps under it. This makes it a very compact multichannel setup. You only have to connect a suitable (Pout total x 1,5) dual secondary windings transformer to this pack.

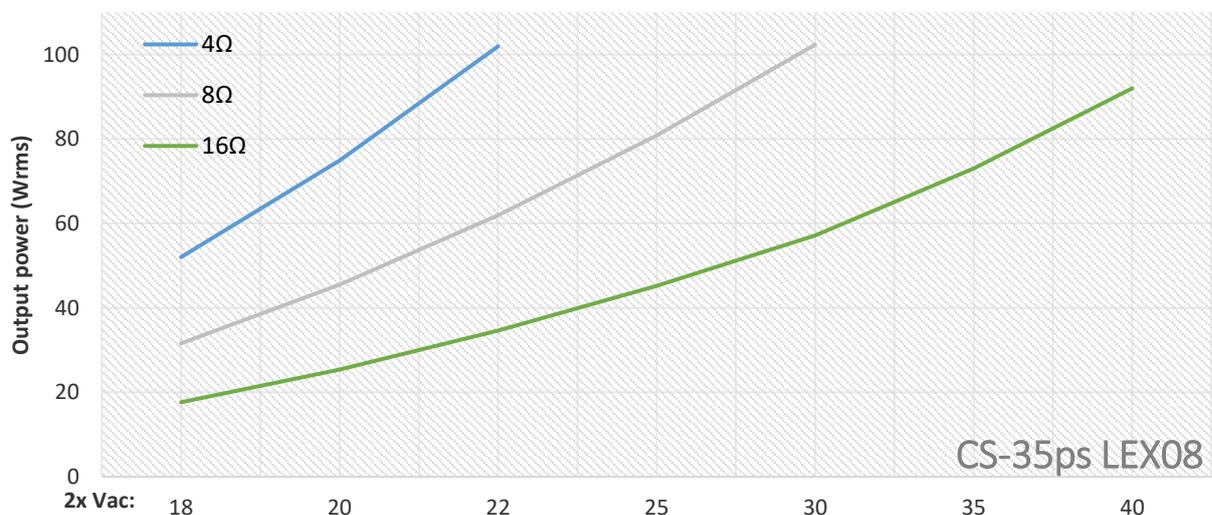
Also the power supply capacitance need to match. We recommend to use >4700uF/100W output.

The elco's rated voltage has to be higher than the voltages supplied, otherwise they will blow in your face!

Type of Fets.

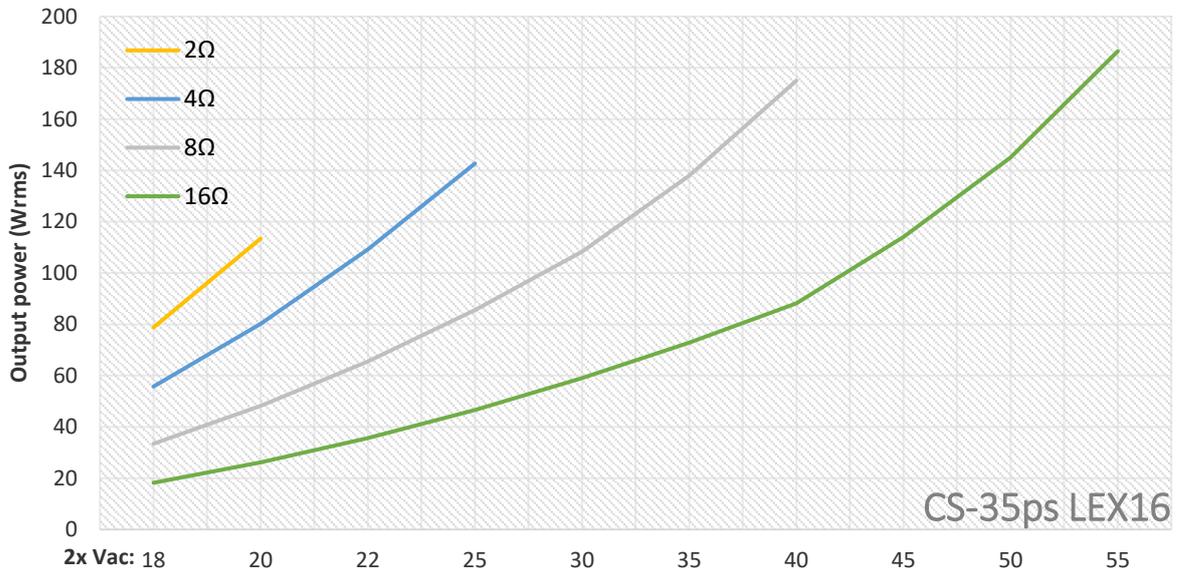
For rugged PA or low cost applications we recommend to use HEXFETs (International Rectifier). These can withstand abuse and at high power have a higher efficiency and output power compared to Mosfets.

For High-End or even better applications we suggest to use the unique [EXICON Mosfets](#). They have a slightly lower efficiency but have a conversion characteristic straight as a ruler, even with a low idle current of around 30-100mA only. They function that linear from that set point on, that it even doesn't make sense to apply more idle current as done with classic transistor class-A setting! They will only dissipate more heat actually.

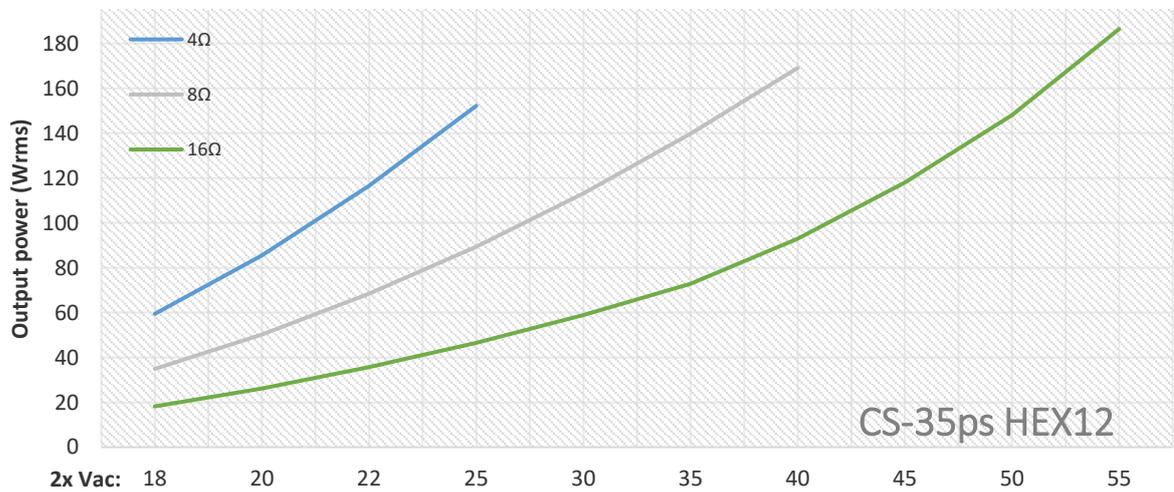


CS-35ps LEX08, with EXICON 8A/200V/125W, TO-247 lateral Mosfets (ECX10N20 / ECX10P20)

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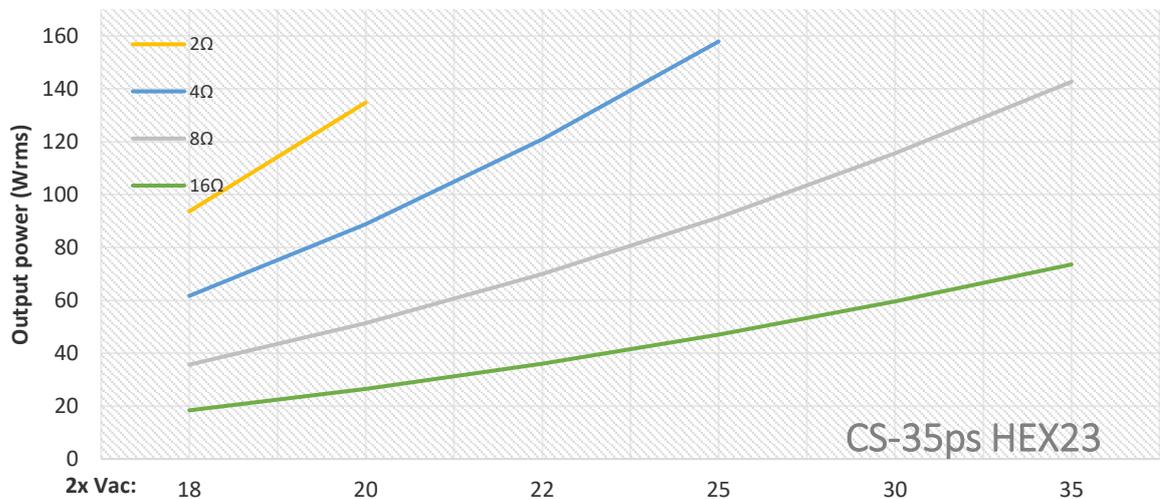


CS-35ps LEX16, with EXICON 16A/200V/250W, TO-264 lateral Mosfets (ECW20N20 / ECW20P20)



CS-35ps HEX12, with IR 12A/200V/150W, TO-247 Hexfets (IRFP240 / IRFP9240)

The power is limited to around 170Wrms due to the Hexfets characteristics. Specialist in high ohmic loads.



CS-35ps HEX23, with IR 21A/100V/150W, TO-247 Hexfets (IRFP140 / IRFP9140)

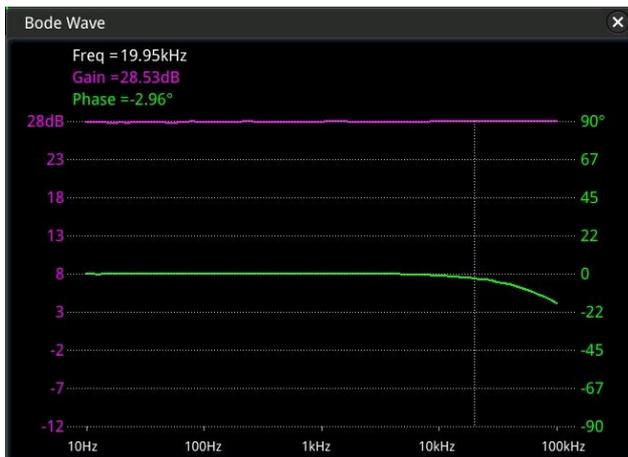
The power is limited to around 140Wrms (2x 35Vac max.) due to the Hexfets characteristics.

Technical specifications:

Frequency range:	DC - 170kHz within 0,2dB
-3dB point:	> 500kHz
Audio band phase shift:	< -3° (20-20000Hz)
Distortion figure (THD):	< 0,005% (1W/1kHz/8ohm) < 0,01% (80W/1kHz/8ohm)
Slew rate:	> 40V/uS (@ +/- 30V). Limited by AC-input filter on VS-module used.
Harmonics:	< -65dB, NONE specific, see graph right below. Actually well below noticeable.
Damping factor:	> 100 - 200 (strongly depending on power Mosfets and supply capacitors used)
Gain:	28dB
Recc. input voltage:	1 Volt
Input impedance:	47kOhm
Output load:	depending on model and supplied voltages, see graphs
Supply voltage:	Dual secondary windings transformer, depending on the model, see graphs
Output power:	depending on the model and supplied voltages, see graphs.
Dimensions:	149x90mm, height depends on type of supply capacitors used.

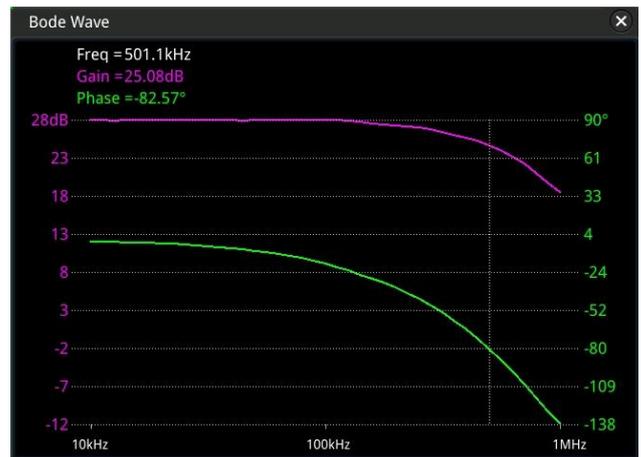
Some measurement data

We ourselves prefer listening over measuring, since our ears and senses are way better instruments than any other equipment. However, since a lot of DIYers want to see figures (acknowledging our senses) instead:



Wide audio bandwidth graph 10-100.000Hz with the marker set on 20kHz.

At this 20kHz the input to output phase error is at a minor -3°, meaning that the 3D staging is phenomenal.



Extended bandwidth graph 10kHz – 1MHz with the marker on the -3dB point. Nice and clean roll offs.

This -3dB point as mostly given is just over 500kHz here.



1kHz square wave signal without any significant irregularities like swing in/out. It also shows a slew rate of around 40V/uS. Please note that high quality opamps hardly reach 12V/uS...



Frequency domain (50kHz wide). Harmonics < 65dB (13+53). The irritating 3rd harmonics (3kHz) is at this low level. Even more irritating 5th is below the scale actually.

Measurement setup:

CS-35 LEX08 with CADDOCK MP725 resistors in feedback and INTERTECHNIK Q6-1,0uF over the power lines + VS-20 input module. Supply voltage ±30Vdc, load 8ohms dummy. Idle current 50mA. Measuring equipment [RIGOL MSO5074](http://www.rigol.com) all in one instrument, all options included.

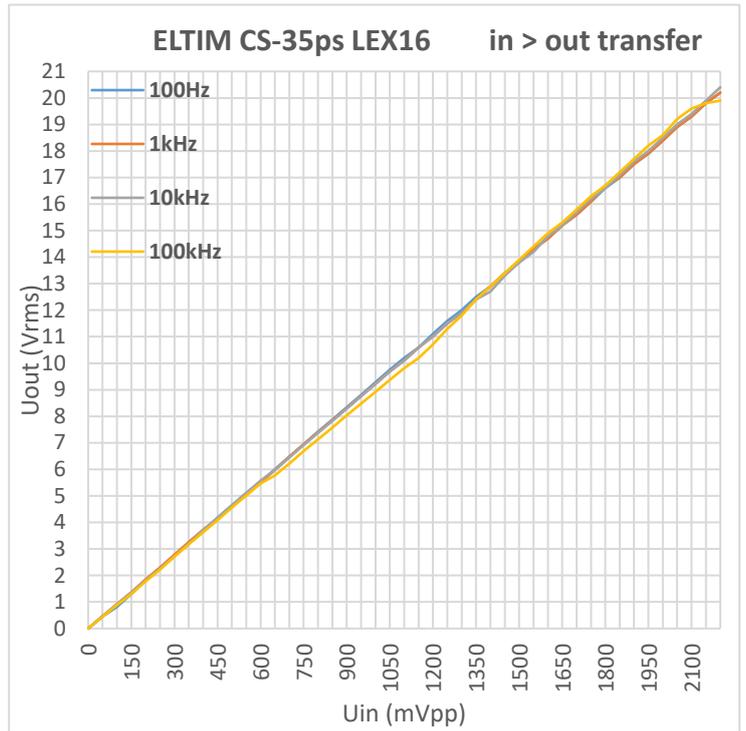
All the above looks impressive indeed, but we also wanted to show a graph nobody else shows:

Here we show the amplification factor for four frequencies with input levels from 50mV – 2,2V with 50mV interval measured steps. The corresponding output level is vertical.

At best all four lines are as straight at a ruler and overlapping each other exactly. Actually, the blue 100Hz line is completely covered by the others in our designs.

If straight, at all levels and all frequencies the amplifier will neither increase nor decrease any instrument or voice character details (their harmonics) at certain levels or frequencies, nor start to “scream” or sounding “dull” at certain levels. We believe ours is close enough, even at a 2V/100kHz level.

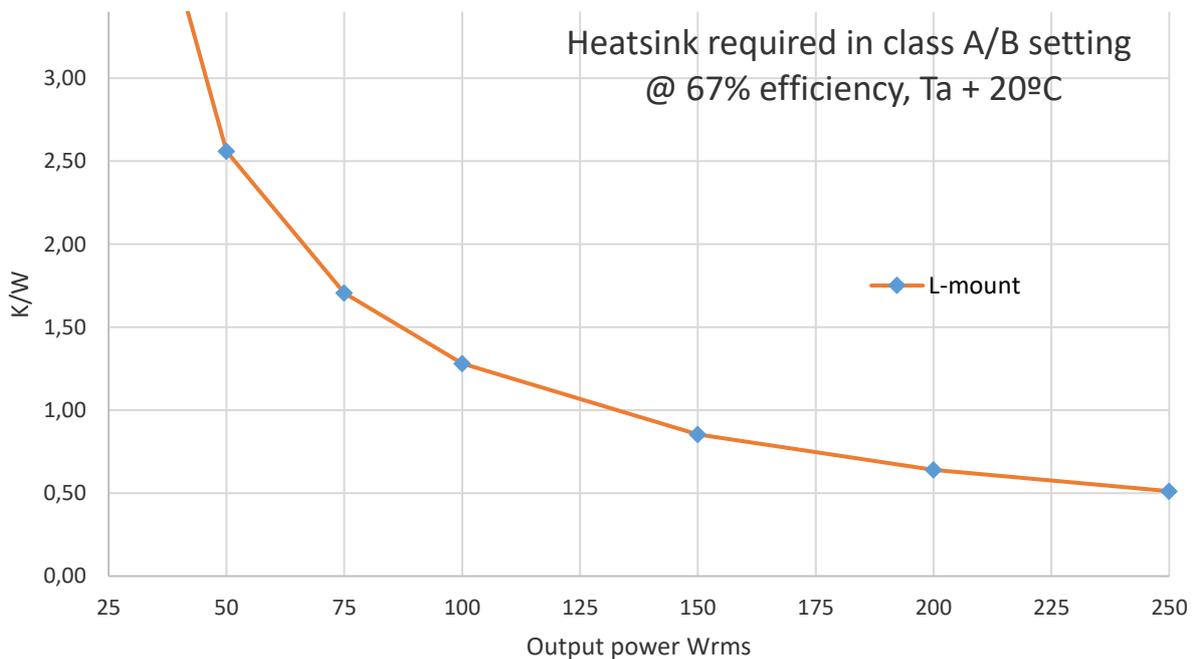
Customers already stated “there is no amplifier”, meaning that it does not affect the sound character of voices and instruments as proved in this and the other measurements. This grave is an acknowledgement of that.



Measured at ±30Vdc and an 8 ohms dummy load. Idle current set at a ridiculous low 100mA > cool amp.

Heatsink data

In this graph you can read the required cooling capacity (K/W) of a heatsink with a certain output power. The graph is recalculated where 33% of power (as always in class A/B) is transferred into heat. We also subtracted a 20°C ambient temperature already. With shown values the heatsink will become around 100°C. If you want it cooler, use a heatsink with a lower K/W rate = temperature rise per Watt heat added.



Connector functions

The 5-pole screw connector is where the two secondary windings of a suitable transformer is connected. Connect one with approx. 1,5x the power of the total Prms output will be.

Just behind the rectifier V-, GND and V+ are available for sandwiched CS-35 module(s).

We split up a power amplifier schematics into a Voltage Stage (input, small voltages) and a Current Stage (output, large currents) in order to get the significantly different results compared to all the rest.

The centre connector is where one of our [VS-5/10/20 Voltage Stage input modules](#) is connected, L-mounted or sandwiched. This last option makes the pack a compact version of around 30mm in height. VS-5 has the same width and is perfectly matching this CS-35ps output module. While sandwiched its secured by 2x M3 bolts.

Please note that only a set of a CS and VS module is a working amplifier! So, you need both.

The input signal is connected to the 2-pole screw terminal of the VS-5 input module. The input capacitor right behind this connector can be bypassed by connecting two solder pads at the back side.

At the left or right connectors (20A, pitch 7,5mm) the speaker leads are to be connected. Use the one closest to the speaker terminals. Since with us it are serious connectors, you can connect up to 4mm² cable to it.

[Find more](#) about our CS-35ps modules.....

DIY remarks

We supply our amp modules as DIY kits as well, so selling them unassembled. As always they then come without MKP supply capacitors in order to give you freedom of choice. Order the types you want separately.

Since this design has a minimum of parts, one hardly could do something wrong and better: learn something. Just solder in the values as printed on the PCB. No R1, C2, T3 table conversion mix up possible.

If you do all as we tell you to, there should be no problems building your own amplifier. If it doesn't work as it should, put it aside for a day and check all for broken and/or misplaced parts, shortcuts, etc. It happens !!

Do yourself and us a favour and do not go into a forum loop where everybody has an opinion, but mostly don't know what's really going on, unfortunately resulting in all kinds of bad texts about us and our products in the Google search pages. We already have some examples of that, just and only because this single guy didn't read our instructions, followed wrong Forum "tips", used incomplete wiring with a bad power supply, etc.

Please [contact us](#) instead, is faster, nicer and resulting in a solution without all this negativity.

Some measuring equipment like an oscilloscope and some experience will help to find your mistakes.

If you have no experience in soldering [check some video's](#) about that on You Tube. Use the widest allowed tip and solder as hot (approx. 300-350°C) and as short as possible, but let the solder flow nice as a small "vulcano". Ball shaped soldering's make bad or even no contact with the PCB, resulting in malfunctions!

Some say you need to solder as cold as possible. Partly we agree to that, saving parts lifespan. However, unlike Chinese crap our PCB's extract heat from the parts and so also from the soldering iron.

The iron temperature is measured inside it and due to this heat extraction the tip itself will be much colder!

If the iron is too cold, soldering takes too long and the parts/PCB will become way more hot than the way we do it as professional electronics repair guys for 40 years without ever any problem.

Several enthusiasts were ahead of you already and built their nice ELTIM based amplifier.

Some even sent us [pictures](#) and/or a [brief review](#).

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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.

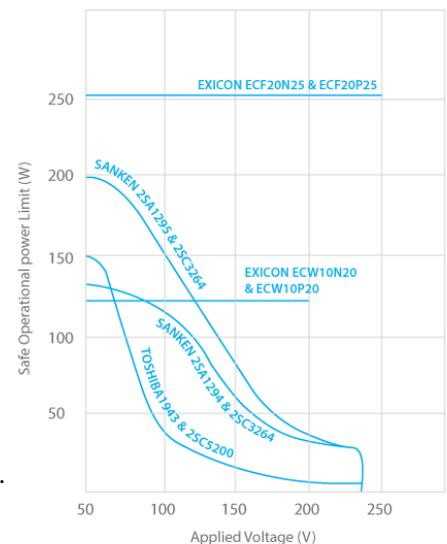
The Fets we use can easily handle these peaks, actually 3-5x more than the supply chain can deliver, so the fuses will blow way before the Mosfets do. We did about all possible, 24 hours of clipping them, etc.

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, wanting 0.00005% distortion). Surprise: you won't hear even 1%.

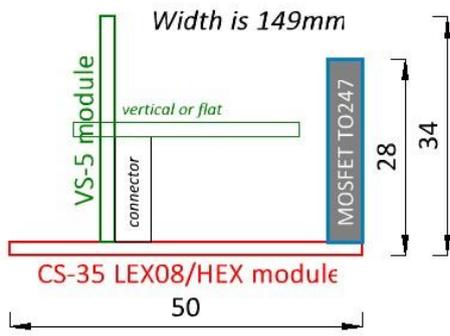
These low figures are easy to make by having a tight feedback. Unfortunately this will kill all musicality! So, we don't. Despite the more basic setup these amps sound different than all the other stuff available. Mainly due to better parts, minimalistic symmetrical schematics, symmetrical layout and way wider copper tracks than others use.

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 singgggggg as they always should do. Not Tsshhh, etc. as heard more and more. Even non-audiophile visitors get tears in their eyes!

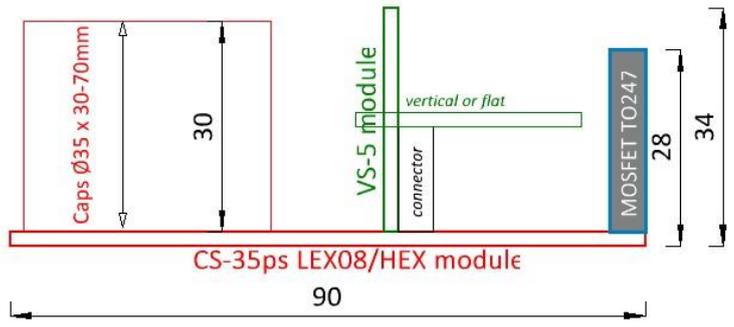
Our experiences are [confirmed by several true audiophile](#) listeners, colleagues and even professional audio reviewers. They all are amazed about the natural sound and fantastic 3D presentation. The "air" around voices and instruments amazes all, incl. us -). We also got some replies mentioning that the bass is deep and very well under control. Some confirmed that ELTIM amps sound 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](#).

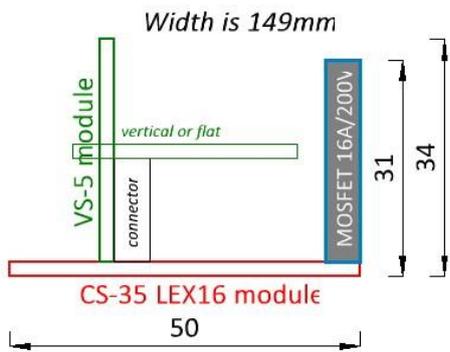


Side view

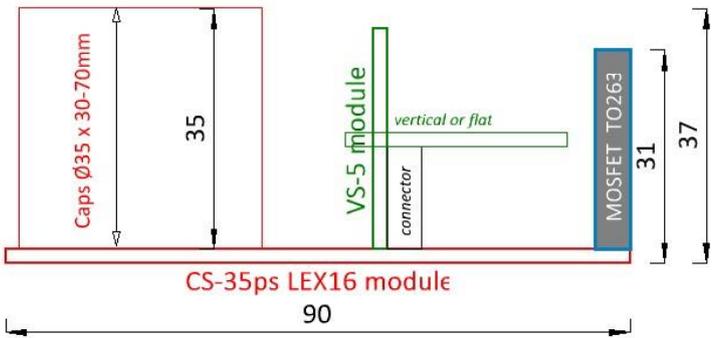


Width is 149mm

Side view



Side view

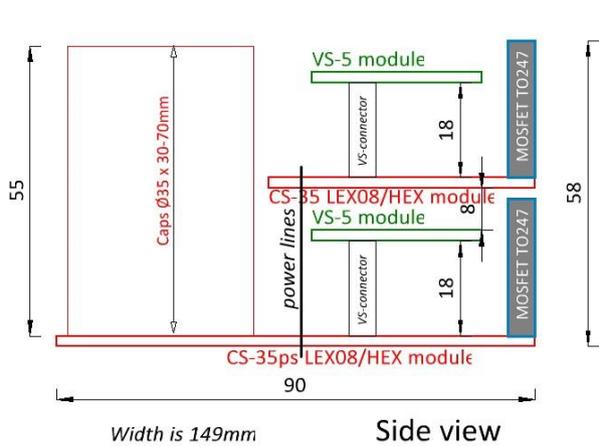


Width is 149mm

Side view

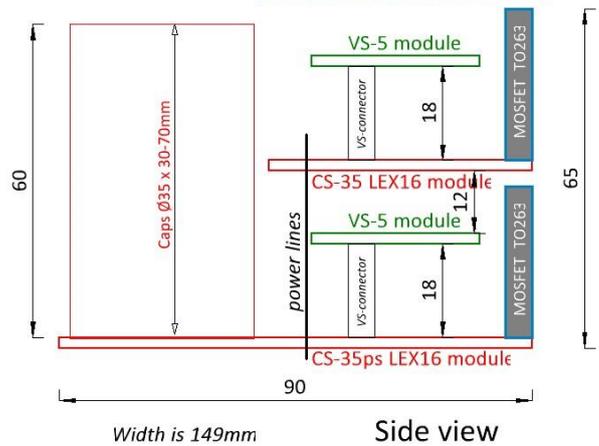
VS-35 module(s) also fit on top of a CS-35ps with integrated power supply, so you can make a very compact stereo, multi-channel or bridged amp:

For active multiway setups you also can use CS-35 LEX08 for mid- and high range



Width is 149mm

Side view



Width is 149mm

Side view

Supply capacitor lengths are given as just below max. height of the modules.