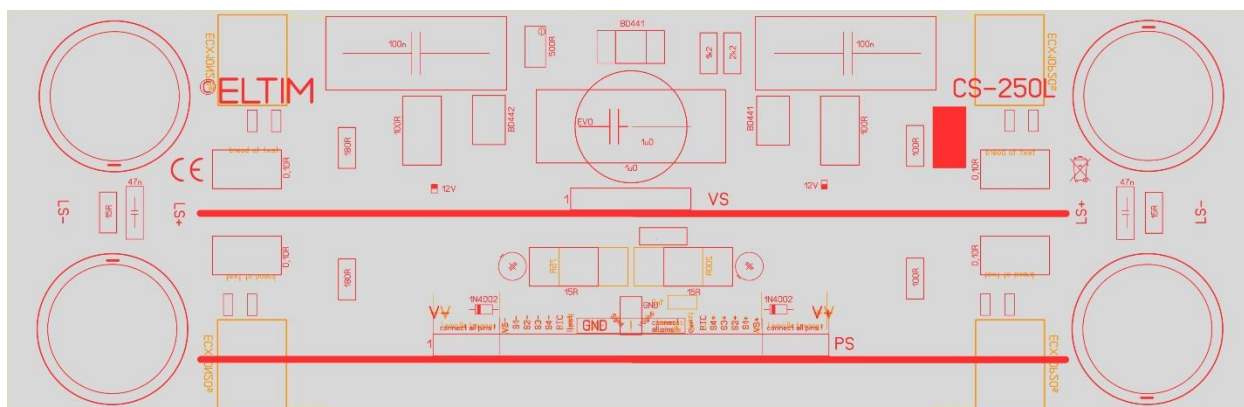
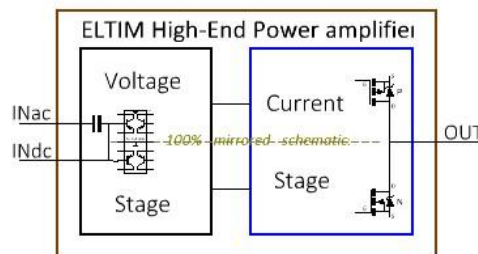


CS-250 Current Stage module

Updated: November 23rd, 2023

With ELTIM High-End amplifier modules we split the amplifier schematics up in a Voltage Stage (VS-module) processing the small input voltages and a Current Stage (CS-module) which processes the large and transient rich speaker currents. While doing so, the PCB layouts can be made way simpler, symmetrical, and designed for their specific task. F.e. CS-modules have unusual wide tracks. Due to this totally different and symmetrical design of our schematics and PCB layout with unusual wide tracks, they sound “tubelike” clean, yet have better and deeper control over your speaker system compared to most other amplifier designs as noticed immediately after the first bass drum or guitar note you hear.

Both a VS-module and a Power Supply (PS) module are connected by high quality milled headers, no wiring!



CS-module with two pairs of 8A EXICON Mosfets, total 16A. Size 290x94mm
Expected rated power: >250Wrms with optimal cooling.

There is space for 2x two Ø30/35mm, pitch 10mm or 4-pin electrolytic capacitors (not included), assisting our PS-2 or PS-3 Power Supply module or your own PS. You can select several types or none in the order process. We strongly advice to use some in any case, they are connected to the Mosfets in shortest, widest possible way!



It exactly fits in MODU Dissipante 300x120mm and Mini Dissipante 300x120mm cabinets and can make around 250W in this cabinet.

There is space to mount chassis plates both on top and bottom at the same time in MODU (Mini) Dissipante cabinets.



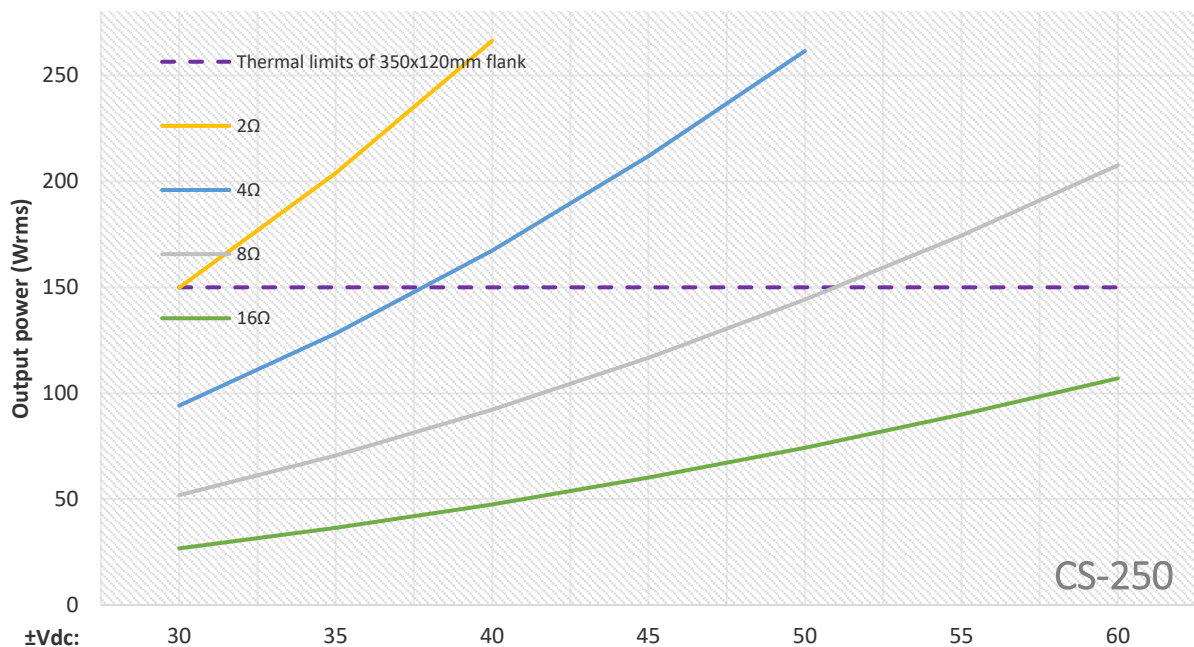
This design also exactly fits the flanks (and slides) of MODU Slimline 350x120mm. You do not need to drill holes in the flanks!

The output power in a 350mm deep version is limited to around 125Wrms due to the flanks heat dissipation limits.

CS-250 General technical specifications (PRELIMINARY):

Frequency range:	DC - >200kHz within $\pm 0,1\text{dB}$
Frequency limit (-3dB):	limited and defined by VS-module used: VS-10: 350kHz, VS-20: 450kHz, VS-50/60: 600kHz)
Frequency limit (-10dB):	700-900kHz (unlimited this CS-250 runs >2MHz....)
In > Out Phase shift:	-0,2° constant @ 10Hz - 18kHz, -3,6°@20kHz
Max. output current:	16A constant (dependant on the heatsink dissipation rate, for max. power < 0,6K/W!)
Distortion figure (THD):	< 0,0005% (1W/1kHz/8ohm) < 0,001% (150W/1kHz/8ohm)
Slew rate:	> 65V/ μS (@ full power). Limited by RF-input filter on VS-module used.
Harmonics:	< -60dB, nonspecific
Noise floor:	<-120dB
Damping factor:	> 250
Input sensitivity:	1 Volt
Gain:	31dB (i.c.w. any required VS-module)
Input impedance:	10kOhm (lower on request)
Output load:	2 – 16 ohms (see load graph)
Supply voltage:	$\pm 30 - \pm 40\text{Vdc}$ (2/4/8/16ohms load) $\pm 30 - \pm 50\text{Vdc}$ (4/8/16 ohms load only!) $\pm 30 - \pm 60\text{Vdc}$ (8/16 ohms load only!)
Max. output power:	260Wrms @ 2ohms (with $\pm 40\text{Vdc}$ supply voltages, larger cabinet required due to extra losses!). 260Wrms @ 4ohms (with $\pm 50\text{Vdc}$ supply voltages). 210Wrms @ 8ohms (with $\pm 60\text{Vdc}$ supply voltages).
Dimensions:	290x94x20mm (exactly fits a 300x120mm MODU heatsink with mounting braces). It also fits in the slides of a MODU Slimline 350x120mm flank, no drilling required !

Output power versus \pm Supply voltage diagram.



Select the supply voltage matching your power requirements.

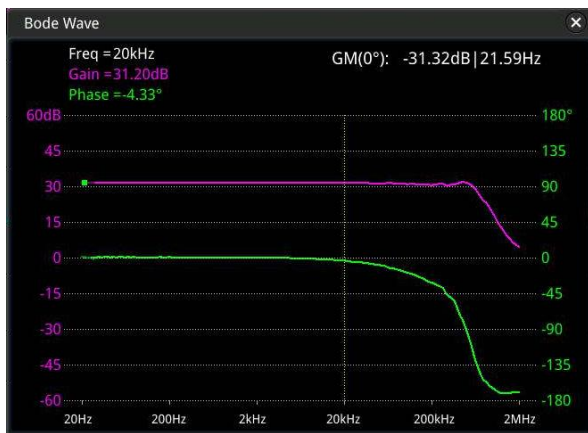
With the power of 250Wrms+ @ 2ohms the max supply voltage is $\pm 40\text{Vdc}$. It produces 180Wrms @ 4ohms then.

Only if you are sure you only use 8/16 ohms speakers, you can increase the supply voltage up to $\pm 60\text{Vdc}$ where this CS-250 makes 210Wrms @ 8ohms which a 300x120mm cabinet.

Note that while used in a Slimline/Galaxy 350x120mm enclosure the power is limited to around 150Wrms due to dissipation restrictions of the aluminium side flank profiles.

FREQUENCY and PHASE BEHAVIOUR (CS-250 prototype version)

In the [Bode graph](#) below we show the gain and frequency graph (purple) as well as the input to output transfer delay given in phase error degrees (green). We used 30 measurements/decade. The values of the yellow, dotted line at 20kHz are shown at left top.



The purple line in the picture is the frequency graph, straight as a ruler from DC to >200kHz.

The -3dB point is around 600kHz, -10dB around 900kHz and limited by us on VS-modules.

Without this safety (possible external caused oscillation) precautions CS-250 runs over 2MHz.

It could work from DC up while using the INdc input at the VS-module.

Very important, yet hardly ever shown is the green line representing the phase (=time delay) between the input- and output signal at different frequencies. This graph simply shows the staging (3D) performance. A flat line would be perfect.

While watching the measurement one can see at the oscilloscope ([RIGOL MSO5000 series](#), all options) that the higher the measuring frequency the more the output comes behind the input signal.

The time shift difference in both signals is presented as the phase.

In this CS-250 (+ modified VS-20) this error is a constant -0,2° in the audio band, only -4,3°@20kHz which is ignorable. In order to obtain this flat phase response, meaning that high frequencies require the same transfer time as low frequencies do, the frequency range must be at least 20x the audible band. So we did, is not easy. Unlike as with most bandwidth limited systems you will not think all the time “something is wrong here” !

STEP RESPONSE

To present “fast” instruments like cymbals, triangle, bells, snare drums, etc. correctly, the step response needs to be as vertical as possible. Basically, this is easily done, but mostly the vertical graph as shown below shows “overshoot” (passing the horizontal line) and “undershoot”, making it a “tssjj” like sound as we hear about everywhere today. Some even believe it must be that way > High-End??

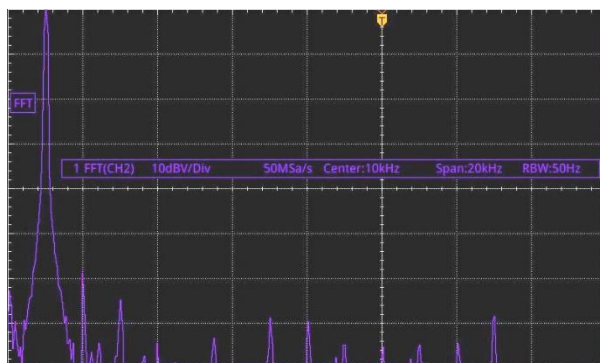
The impulse response with a 1kHz/150mV square wave input signal is “by the book”, no over- nor undershoot.

With the extremely wide frequency response of 600kHz, preventing over/undershoot is very difficult to achieve and mostly simply accepted. The “speed” of the vertical incline is measured in V/us, with us >65V/us @ full power, being >3x faster than best quality opamps used in studio mastering sets.



HARMONICS

Harmonics are frequencies of multiple base tone made by the circuit itself and can be represented in a FFT ([Fast Fourier Transformation](#)) diagram. Their effect is part of many discussions. Fact is that this combination of added tones partly gives the amplifier its “sound character”. The less harmonics produces, the cleaner the sound. Some of our customers stated that with our (more simple) amps “there is no amplifier present”. Nice.



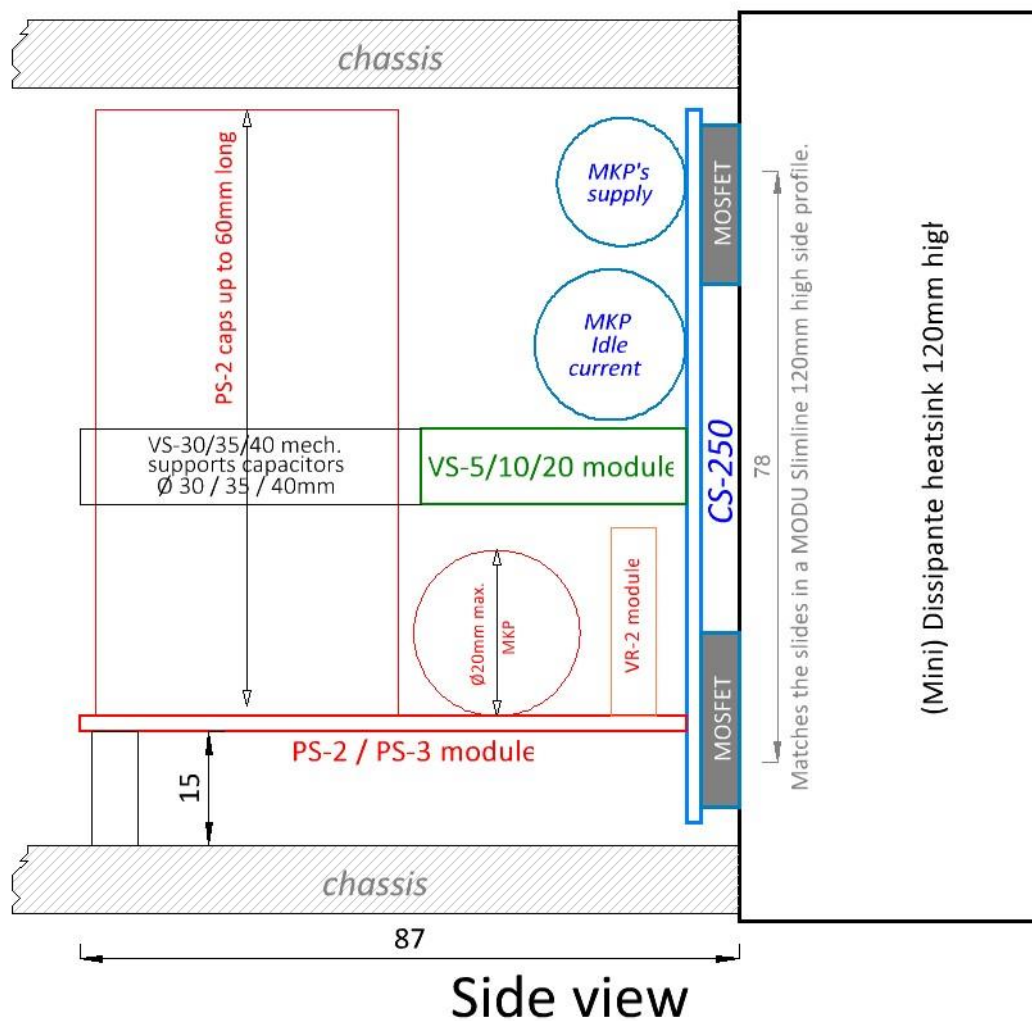
1kHz/1V sine wave input tone (left peak) with the resulting multi frequency harmonics peaks in purple.

FFT transformation shows that the only few harmonics are way below audible level, <<65dBv. All are similar in size, nonspecific present and way below critical level.

The largest one is the second harmonics, 2kHz @ -60dB. Second harmonics (as many tube amps show) are experienced as pleasant. Most solid statd systems show an as unpleasant experienced third harmonics (so 3kHz) here.

The noise floor is < 120dB and cannot be heard.

Full scale (1:1) view of a CS-250 / VS-xx / VRxx and PS-2/3 combination:



Scaled 1:1 if your printer is set to 100%

In blue the CS-250 mounted to a 120mm high heat sink like in MODU 3U (Mini) Dissipante cabinets.
There is space to mount a chassis plate both at top and bottom at the same time!

In green we show a connected VS-5, VS-10 or VS-20 input stage module.

In black the VS-30/35/40 input module.

They are the same as VS-20 (green), but are "stretched" in length, allowing for Ø30, Ø35 or Ø40mm holes exactly surrounding the large supply capacitors on the PS-2 or PS-3 power supply modules.

Largest fitting capacitor size is Ø40x60mm.

While doing so, these large and heavy capacitors are mounted free from vibrations and mechanical stress to especially their soldering's, being limited to about zero then.
If your amp is transported a lot, we recommend this option to prevent "cold" soldering's!

In purple we show the position of a VR2-30 Voltage Regulator module, providing regulated voltages to VS-xx.
This module is required while operating at > ±35V i.c.w. VS-20/30/35/40, also improving sound quality.

VERSIONS

In our new 2024 series CS-modules we introduce two quality levels, using different quality parts, resulting in sound differences and (as always) a serious price difference....

CS-250	Standard (ST)	High-End (HE)	Reference (REF)
Power Mosfets	2 pairs IR HEXFETS IRFP240/IRFP9940 12A/200V, TO247	2 pairs EXICON lateral Mosfets ECX10N20 / ECX10P20 8A/200V, TO247	
Electrolytic capacitors	4x TDK/EPCOS 4700uF/63V, 105°	4x NICHICON UKW 4700uF/63V, 105° Audio Grade	4x MUNDORF MLGO 4700uF/63V, 125° Audio Grade, long life
Idle current capacitor	PANASONIC ECW	MUNDORF MCAP400	MUNDORF SUP8
Power resistors	8x BOURNS PWR163 5%, low induction	8x BOURNS PWR163 1%, low induction	8x CADDOCK MP725 1%, induction free
Other resistors	Standard MOX 0,6W, 1%		DALE RN60 , 1%, military grade
PCB	Eurocircuits (EU), FR4+, double sided 2x35um, tin plated solder isles		
Solder	Any lead-free solder	MUNDORF MSOL.SG Sn95,5Cu0,7Ag3,8Au	MUNDORF MSOL.SUP Sn88,6Cu1,8Ag9,5Au0,1

We produce by hand, so we can mount other parts if you like.
Just mention it in the comment line of the order form.
We will respond with a modified offer.

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

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