

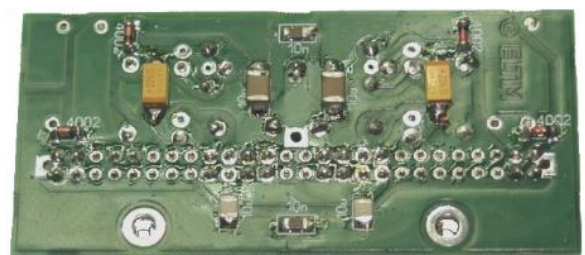
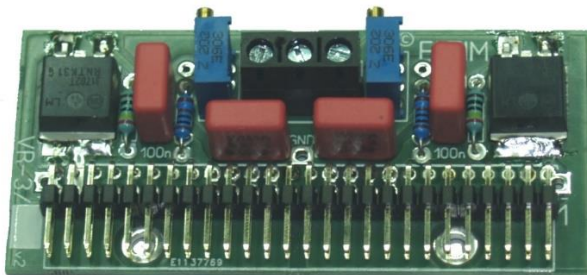
## VR-3/xx v2 Voltage Regulator module

Where high Power rail voltages are used on our VS/CS amplifier modules and/or where even an improvement in sound quality is desired, the supply voltages of our VS-board could be regulated down. For this purpose we developed this very compact VR-3 board, fitting on about all our Power Supplies.

This very compact Voltage Regulator board appears to be useful for universal purposes also, where a regulated symmetrical voltage is required, f.e. in pre-amplifiers, DAC's, CD players, etc. With the v2 version we just changed the PCB layout a bit and made entries for fixed wire inputs as well as two Ø3mm holes for mounting it in existing gear.

Since a power supply circuit is part of the AC-signal chain ( ! ) the impedance (AC resistance) of the power supply lines has to be as low as possible AND as constant as possible over the full audio range. Unfortunately, electrolytic power supply capacitors have an increasingly bad behaviour with rising frequencies. In order to compensate this effect, there should be one or more regular capacitors (pref. MKP) with small values parallel to them as we do in all our modules. The better quality used, the better the compensation. By regulating a power supply voltage, one not only brings it down to the required voltage. Due to the regulating qualities of the circuit, the impedance of the power supply is drastically reduced and unaffected by the preceding main power supply circuitry and load demands. The impedance can be measured partially in a simple way, since the voltage drop while loading the power supply represents the value of this impedance. Check it while driving the amp with different frequencies and you will notice differences.

- Some of the highlights of this [VR-3/xx](#) Voltage Regulator module:
  - LM317/337 controlled +/- V output, adjustable by changing a single resistor.
  - "Floating" regulation (no connection to ground), so it can be used even to regulate high voltages.
  - RF-interference blocking capacitors in strategic positions.
  - L-mounted to CS-40ps, and on most of our PS-boards or universal use by a header.
  - Instead you could use wires for connection to an existing Power Supply (v2)
  - 3-pole screw terminal where regulated output voltages are also available.
  - Either fixed voltages and 0,3% trimmed and wide range adjustable models.
  - 3mm holes in 40mm distance under unused header pins. Cut those for fixed mounting.
  - +IN, GND and -IN contact holes for hard wired connections.
  - Dimensions: 75x35x8mm.



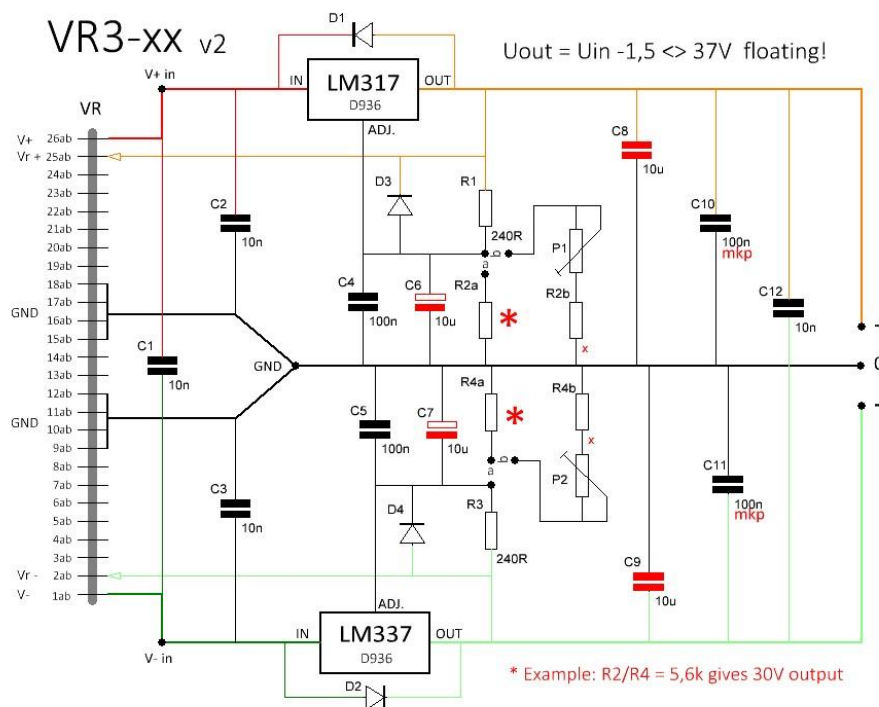
In our High-End amplifiers we separated the VS-module power lines from the CS-stage power lines. Due to this we are able to provide regulated supply voltages for this input stage VS-module of our High-End amps. This will bring the effects as described above.

There is also a 3-pole screw terminal (Vr+, GND, Vr-) fitted on this tiny board.

You could use these for other purposes as well like driving a preamplifier circuit while using our modules.

## Circuitry

In this VR-module we use the LM317 for positive voltage regulation and the hard to get LM337 negative Voltage regulator, both in SMD version. Both are way better than 78xx/79xx in dynamic behaviour. We also have the VR-4 model, using TO220's with coolers for higher loads available in our web shop.



Instead of a fixed resistor for  $R2/R4 (=R2a/R4a)$  you can mount a combination of  $R2b/R4b$  and a pair of multturn trimpots for exact adjustment of the output voltages. Capacitors in red are added compared to v1 versions. This increases stability, see technical notice below.

As always and as recommended by TI, strategic RF-decoupling over the power lines is included. 10nF capacitors decouple between the inputs and to ground. 100nF MKP4 capacitors decouple the output voltage rails to ground. An extra 10nF capacitor between both output voltage rails reduce noise further and prevents any EMI in whatever case you are using our VR3-xx. By doing so, we also provide lowest impedance possible at higher frequencies. All SMD components are located at the back of the PCB.

For the same reason of multipurpose use, we added 4 diodes which are normally not necessary. Doing so though, allows you to connect >22uF of output capacitors to this circuit or connect f.e relays without damaging the LM's, see the datasheets of these. So, we used max. schematics as advised by the manufacturers, and more actually. All on a PCB, just measuring just 75x35x8mm.

**TECHNICAL NOTICE:** So far we only used v1 versions in our [High-End amplifiers](#) where only a few mA is taken. For years we didn't experience any problems with this VR-3 module. Then we started to use V1 versions in other circuits as well and found out that in specific cases where quite some current is taken especially the negative side could show some slight oscillation (@ 360kHz) and even the voltage could drop significantly, both unwanted issues of course. Both issues can be fixed easy by adding 10uF/50V SMD tantals (yellow ones in the picture at first page) over the C4/C5 100nF MKS4 capacitors. These extra tantals fit between the solder isles exactly, so soldered there very easy. Adding them in your v1 (sold < okt. 2020) will improve stability and overall sound quality while mounted in our High-End amps! If you send the modules to us, we will mount them for you, totally free of charge. Mounting these 10uF's will stop this possible oscillation and the voltage drop doesn't occur any more. Performance even increases if also >4,7uF are mounted over the outputs as well. In most circuits these are mounted somewhere already as f.e. on our CS-xx modules! If not there, we recommend to mount these as well. Mount them over the screw connector.

In this v2 version we added 10uF/50V tantal caps over R2 and R4 as well as over the outputs, problem solved. Due to rock solid supply voltages at all times now, the [high sound quality](#) of our amps of course also further increases -) Curious how an unexpected issue can be solved so easy and doing just a slight modification can change so much.

### High voltage regulating / Floating device

Unlike about all other voltage regulator IC's, LM317/337 are so called floating devices, meaning that the IC itself has no ground connection, just like f.e. a transistor. This means that, despite the fact that about everybody else tells you that  $V_{out\ max.}$  is 37V, this IC can regulate ANY voltage, as long as  $V_{in} - V_{out} < 37V$ . So, with that in mind, you could f.e regulate a 280V (tube) voltage down to say 250V without a problem.

On request we can supply our VR-3 modules with any output voltage you require, but keep in mind that  $V_{diff.} = 37V$  max. Only restricting issue is the max. voltage the capacitors used can withstand and the minimum track space ( $\approx 1,5mm$  in VR3 modules) between supply and ground track allows actually.

While ordering high voltage types we will alter these caps accordingly.

The differential voltage (meaning the voltage over the LM's) strongly influences the max. output current.

The graphs at the last page show the output current vs diff. voltage in respect to the max. dissipation of the LM's, here SMD types mounted directly to the double sided PCB which act a bit as a cooling surface.

These LM's are protected against over current (1,5A) and over temperature, the reason why the line is horizontal (1,5A) at the top. In practise, the larger the voltage difference between input- and output voltage, the earlier the over-temperature and or SOA circuitry will become active, so earlier than 1,5A output current.

### ELTIM High-End amplifier power On/Off irregularities

Mostly due to our full symmetrical designs, our VS/CS amps modules hardly show irregularities while switching on or off. Switching them on, there could be a tiny "tick" noticeable, but **NO uncontrolled woofer movement !** While switched off, the woofer also stays around centre position, but for a short moment there could be some minor distortion, where the supply rail voltages dropped to around 15V and then goes silent.

Instead of using an output relay, you could use one of our VR-modules in order to prevent any power up/down irregularities in the output at all. Its more elegant than a blunt power relay. Please note: many believe while seeing this relay it has a protection function. Mostly it's not, it just comes in delayed and switches off fast while powering down! Just masking the amp's unbalance while powering up/down. Note that most relays distort on low level signals due to the contact material used (mostly Wolfram).

While adding our VR-3 module in our amplifier designs, the switch on/off irregularities become even better. First the CS-voltages come in, but without any current flowing. Shortly after, the VS-Stage is fired up by this module and setting the CS-module in the adjusted mode. Since the VS voltage stops increasing more early due to the regulating effect of this VR-3 module, the amp becomes stable faster as well.

While powering down, the VS-stage loses power sooner too, resulting in disconnecting the power Mosfets before the supply voltage becomes too low and so preventing undesired side effects at power down.

### Use in our Preamplifier designs

In our PRE-230 and PRE-330 [preamplifier modules](#) there are relatively small supply transformers used. Law of nature is that these by definition have a relatively high internal resistance, causing a significant supply voltage change, depending the load. While using this VR-3 module, the supply voltage to **all** audio electronics is regulated linearly in a very good way and more: it has, unlike commonly used 78xx/79xx regulators, a constant character over the full audio range. With all electronics we also mean possible added active input/output modules connected. The in/output relays and (possible) digital circuits are fed via separate supplies.

On PRE230/330 preamp modules we provide a header connector for most of our symmetrical VR-modules.

We recommend to use VR-2 or VR-3 modules in  $\pm 9V$  (9V trafo) or  $\pm 12V$  (12V trafo) versions.

Both appear to work very satisfactory since the drop over the regulator IC's is just over the minimum 2,5V.

This VR-3 can also be used in most of our linear working, symmetrical [Power Supply modules](#).

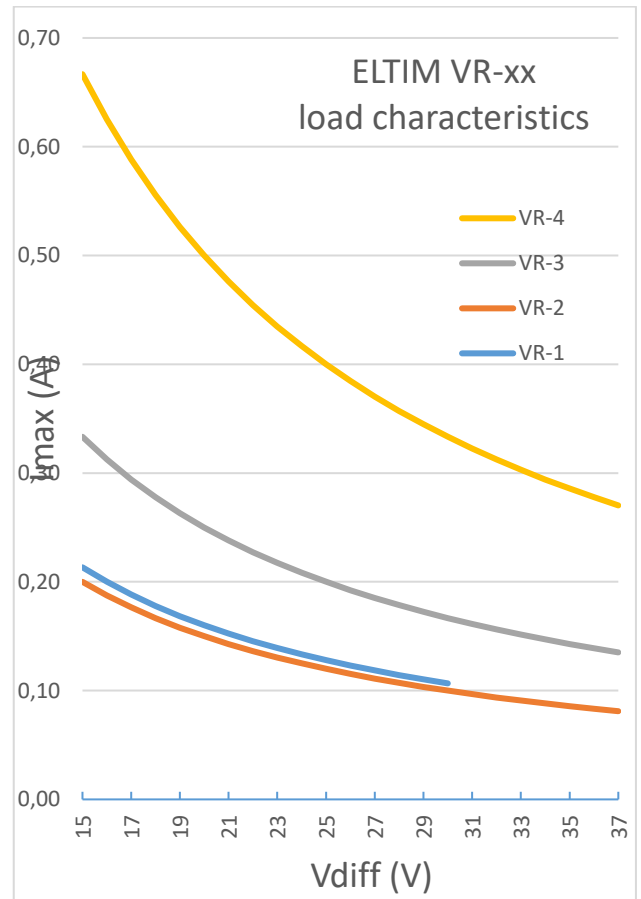
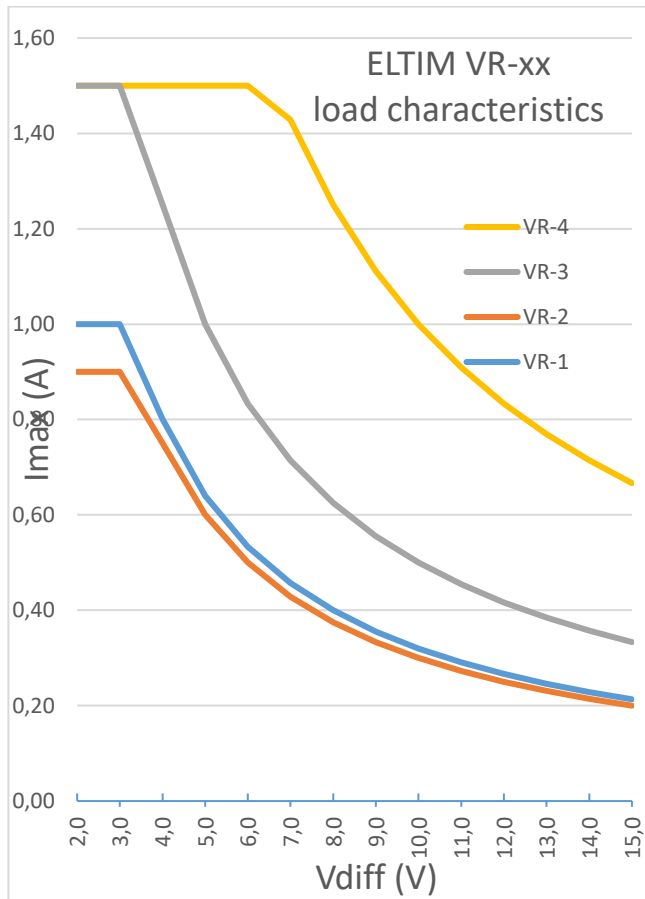
[Check our website for ordering](#)

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## ELTIM VR-3 specifications



Typical data for ELTIM VRx-yy modules, positive side. Negative values are the same, yet inverted.  
Data is long term measured where the T<sub>max</sub>. protection is just not in action.

V <sub>diff</sub> . definition:	Difference between input- and regulated output voltage.
V <sub>diff</sub> . minimal:	2,5V, floating
V <sub>diff</sub> . maximal:	37V, floating, meaning that the input voltage can be about any voltage, as long as it is < V <sub>out</sub> + 37V!
Regulating voltage range:	1,25 – 100V to ground
Available standard voltages:	±3,3V; ±3,6V; ±5V; ±6V; ±8V; ±10V; ±12V; ±15V; ±18V; ±24V; ±30V and trimmable versions where you can set the outputs with 25 turn trimmers as in the pictures shown. We can trim <0,3%.
Wide range trimmable types:	±1,5-8V, ±6-16V, ±12-28V, ±22-50V and ±40-100V. (V <sub>diff</sub> < 37V !) Any other output voltage (range) on request, up to 100V.
I <sub>max</sub> :	Depending on V <sub>diff</sub> ., see tables
Type of regulator IC's:	LM317 / LM337 D2PAC-3 SMD types
Protection:	Thermal (180°C), SOA, overload and shortcut protections
Size:	75 x 35 x 12 mm

[Check our website for ordering](#)

OEM and dealers are most [welcome](#).

We are most probably also able to develop and/or build about any circuit you like.

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