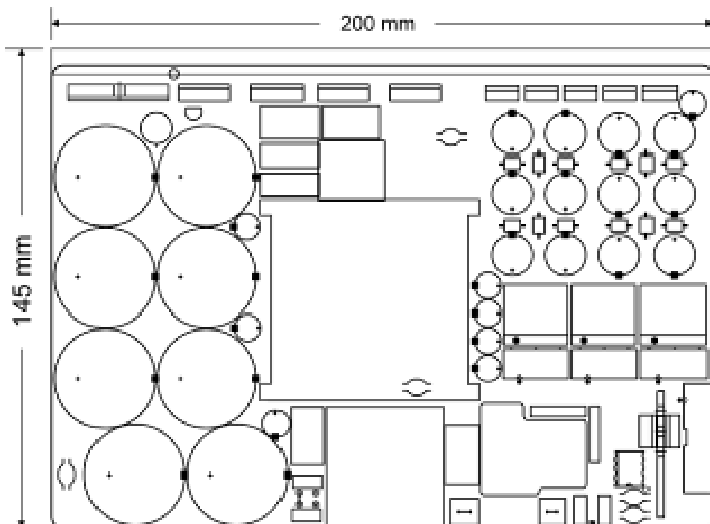
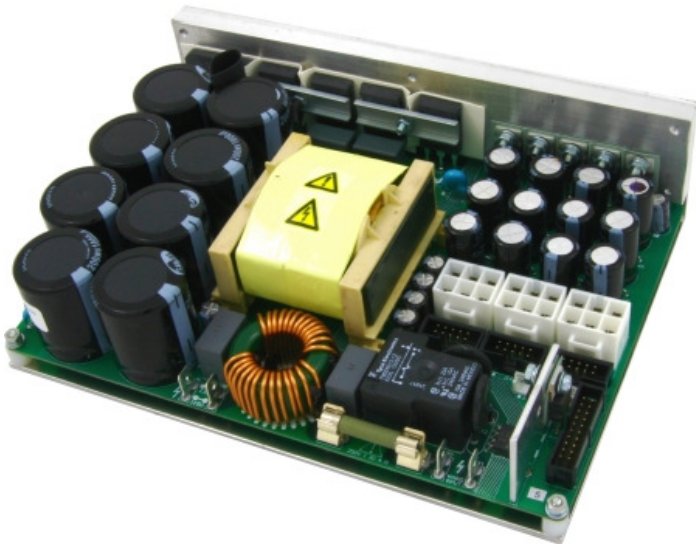


## High Efficiency High Power Audio SMPS



### Highlights

- High efficiency
- Selectable input voltage range
- Low EMI

### Features

- Advanced over current protection
- Remote controlled operation
- Low weight: 1,5kg
- Compact: 200 x 145 x 55mm
- Fixed output voltage

### Applications

- Supply for single or multiple amplifiers of the UcD range
- Active loudspeakers

### Description

The SMPS3K is a high efficiency Safety Class 1 switch mode power supply specifically designed for use with our range of UcD amplifier modules. Key features are high efficiency over the entire load range, extremely small form factor, low weight and very low radiated and conducted EMI. The SMPS3K also features an advanced over current protection which in case of temporary overload limits the output current, only when the overload condition remains for a longer time the supply will enter hiccup mode until the overload condition disappears. This feature combined with large primary electrolytic buffer capacitors leads to the capability of delivering high dynamic headroom power to the connected amplifier. The SMPS3K also includes an auxiliary isolated  $\pm 23V$  supply and a control circuit directly interfacing with our range of (OEM and standard) UcD amplifier modules. The supply is triggered for normal operation or latched off in case of critical fault via in built-in actuators. The SMPS3K is optimized from the first phase of design to final implementation to realize the lowest possible EMI signature required of the most demanding audio applications.

## High Efficiency High Power Audio SMPS

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### 1 Principle of operation

Conventional Switch Mode Power Supplies are commonly unsuitable for audio purposes due to poor peak power capabilities. The Hypex SMPS3K achieves this by using an advanced over current protection circuit and has a peak power handling of many times its rated power.

### 2 Safety precautions

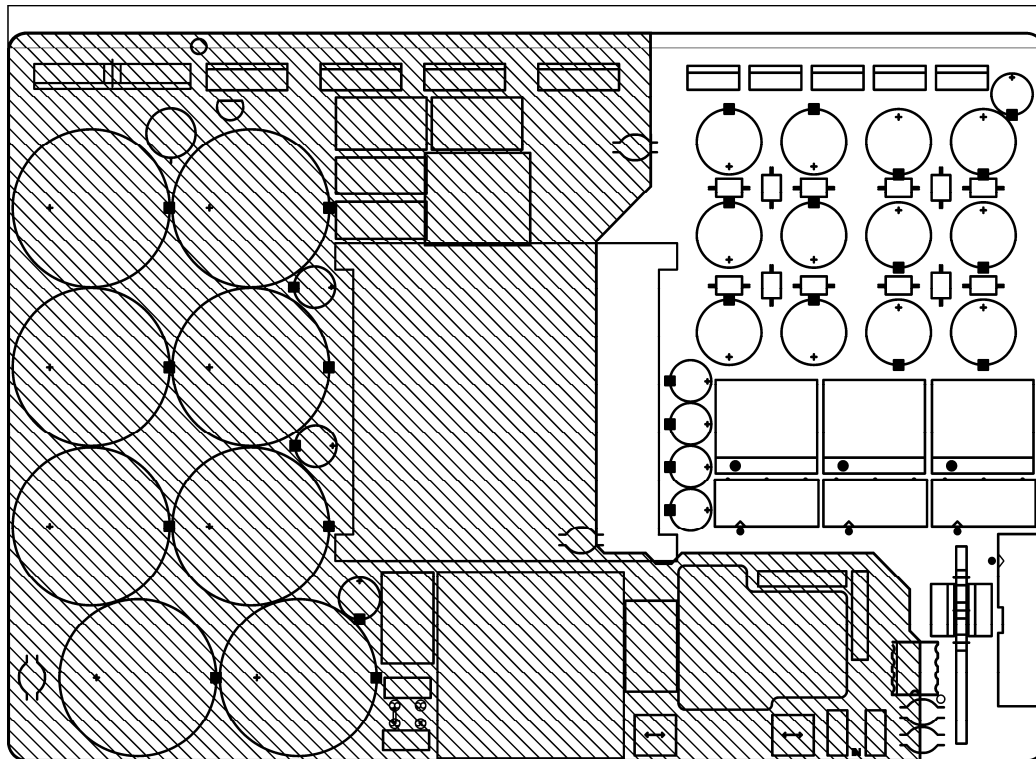


The SMPS3K operates at mains voltage and carries hazardous voltages at accessible parts. These parts may never be exposed to inadvertent touch. Observe extreme care during installation and never touch any part of the unit while it is connected to the mains. Disconnect the unit from the mains and allow all capacitors to discharge for 30 minutes before handling it.

This product has no serviceable parts other than the on-board fuse. Replace the fuse only with the same type and rating (250V T30AH).

This is a Safety Class 1 device. It is very important to maintain a 3mm clearance with all possible conducting parts (housing etc.) and cables. All parts enclosed by the hatched area carry hazardous voltages. This includes parts on the top and the bottom of the board.

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This symbol indicates the presence of hazardous voltages at accessible conductive terminals on the board. Hatched parts are conductively connected to the mains and carry lethal voltages! Not hatched parts are not conductively connected to the mains also carry voltages up to 200VDC!

### 3 Application restrictions

The SMPS3K is intended to power our high power UcD2K amplifier modules. As a result this SMPS product does not feature the 2 quadrant operation as most of our other SMPS products do, so they are unable to handle large reverse currents generated by half-bridge amplifiers operated at low frequencies. For this reason it is not advisable to use this SMPS to power half bridge amplifiers like our UcD700 modules when used in the frequency range below 100Hz.

### 4 Instructions for Installation

Standard the SMPS3K is supplied as a module mounted on an L-shaped aluminium frame. This creates the mandatory 3mm clearance from the bottom side of the PCB to the chassis without the need for additional insulating material. However, if the enclosure is limited in height one could consider to drop the L-frame and use shorter spacers to mount the PCB onto the chassis providing a layer of insulation both above and below the SMPS with a minimum thickness of 0.4mm in order to comply with the Class 1 Safety Directive.

**Warning:** To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.

**Warning:** Disconnect the unit from the mains and allow all capacitors to discharge for at least 30 minutes before handling it.

## High Efficiency High Power Audio SMPS

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the application.
6. Only use attachments/accessories specified or approved by the manufacturer.
7. Unplug this apparatus during lightning storms or when unused for long periods of time.
8. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally or has been dropped.
9. This product is to be used with Hypex amplifier modules only.
10. Only the ready-made cable sets provided by Hypex may be used for external wiring of the SMPS3k.
11. Don't run any cables across the top or the bottom of the SMPS3k. Apply fixtures to cables to ensure that this is not compromised.
12. Observe a minimum distance of at least 3mm clearance with all possible conducting parts (housing etc.). This includes parts on the top and the bottom of the board. When the SMPS3k is mounted in a tight space there needs to be at least 3mm clearance or a layer of insulation with a minimum thickness of 0.4mm between the top of the transformer and the housing.
13. Natural convection should not be impeded by covering the SMPS3k (apart from the end applications housing).

## 5 Absolute maximum ratings

**Correct operation at these limits is not guaranteed. Operation beyond these limits may result in irreversible damage**

Item	Symbol	Rating	Unit	Notes
Input Voltage	$V_{LINE}$	270	Vac	
Air Temperature	$T_{AMR}$	50	°C	
Heat-sink Temperature	$T_{SINK}$	95	°C	

## 6 Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Notes
High Line Input Voltage	$V_R$	180	230	264	Vac	
Low Line Input Voltage	$V_{R,FP}$	90	115	132	Vac	
Line Input Frequency	f	47		63	Hz	

## 7 General Performance data (All versions)

Item	Symbol	Min	Typ	Max	Unit	Notes
Unregulated Output Voltage	$V_{OUT}$	2 x 66	2 x 85	2 x 97		<sup>3)</sup>
Unregulated Output Voltage Aux	$V_{OUT,AUX,REG}$	2 x 18	2 x 23	2 x 26	Vdc	<sup>3)</sup>
Regulated Output Voltage Aux	$V_{OUT,AUX,REG}$		2 x 12		Vdc	<sup>3)</sup>
Unregulated Output Current Aux	$I_{OUT,AUX}$	500m	-	-	A	per rail
Regulated Output Current Aux		100m	-	-	A	per rail
Max Output Power	$P_R$	3600	-	-	W	<sup>1)</sup>
Max Audio Output Power @ 20Hz (into amplifier load)	$P_{RALF}$	3000	-	-	W	<sup>2)</sup>
Efficiency	$\eta$		95		%	full power

## High Efficiency High Power Audio SMPS

Idle Losses	$P_0$		20		W	
Standby Power	$P_{standby}$		200m		W	
Switching frequency	$F_{sw}$	80	100	120	kHz	

**Note 1:** Output Power delivered to a resistive dummy load (generally the only specification supplied by other SMPS manufacturers).

**Note 2:** An audio amplifier actually draws twice the RMS power from the power supply. At high frequencies the secondary storage output caps are capable to provide this power. At very low frequencies however the SMPS is responsible for delivering this peak power to the amplifier.

**Note 3:** Output voltage is proportional to the mains line voltage (Typical 230Vac).

### 7.1 Output Power Performance data

The SMPS3K is designed for music reproduction and is therefore not able to deliver its maximum output power long-term. The RMS value of any common music signal generally doesn't exceed 1/8<sup>th</sup> of the maximum peak power. The SMPS3K is therefore perfectly capable of driving the connected amplifier in clipping continuously with a music signal without the need of forced cooling.

Unless otherwise specified.  $T_0 = 25^\circ\text{C}$ . Connected amplifier: 2 x UcD7000EMV4 + 1 x UcD2K,  $f = 1\text{kHz}$ . SMPS3K is horizontally mounted in free air without additional external cooling. The SMPS3K was preheated at 1/8 $P_R$  (2 x 100W + 1 x 175W@ 1kHz into 4 Ohm amplifier load).

Item	Symbol	Conditions	Min	Typ	Max	Unit	Notes
Amplifier output power for 30 sec. until $T_{SINK,MAX} = 95^\circ\text{C}$	$P_o$	Load = 4Ω 100Vac/60Hz 230Vac/50Hz		TBD 2000		W	
Amplifier output power for 1 min. until $T_{SINK,MAX} = 95^\circ\text{C}$	$P_o$	Load = 4Ω 100Vac/60Hz 230Vac/50Hz		TBD 1500		W	
Continuous output power. $T_{SINK,MAX}$ stabilized at 95°C	$P_o$	Load = 4Ω 100Vac/60Hz 230Vac/50Hz		1000 1000		W	

## 8 Connections

The SMPS3K is designed to directly connect to our range of high power UcD amplifiers. Three heavy duty JST B06P-VL interfaces are available. The only connection to the customer application needed is done by a 20p boxheader (J16) or a 7 pole JST (J4).

## High Efficiency High Power Audio SMPS

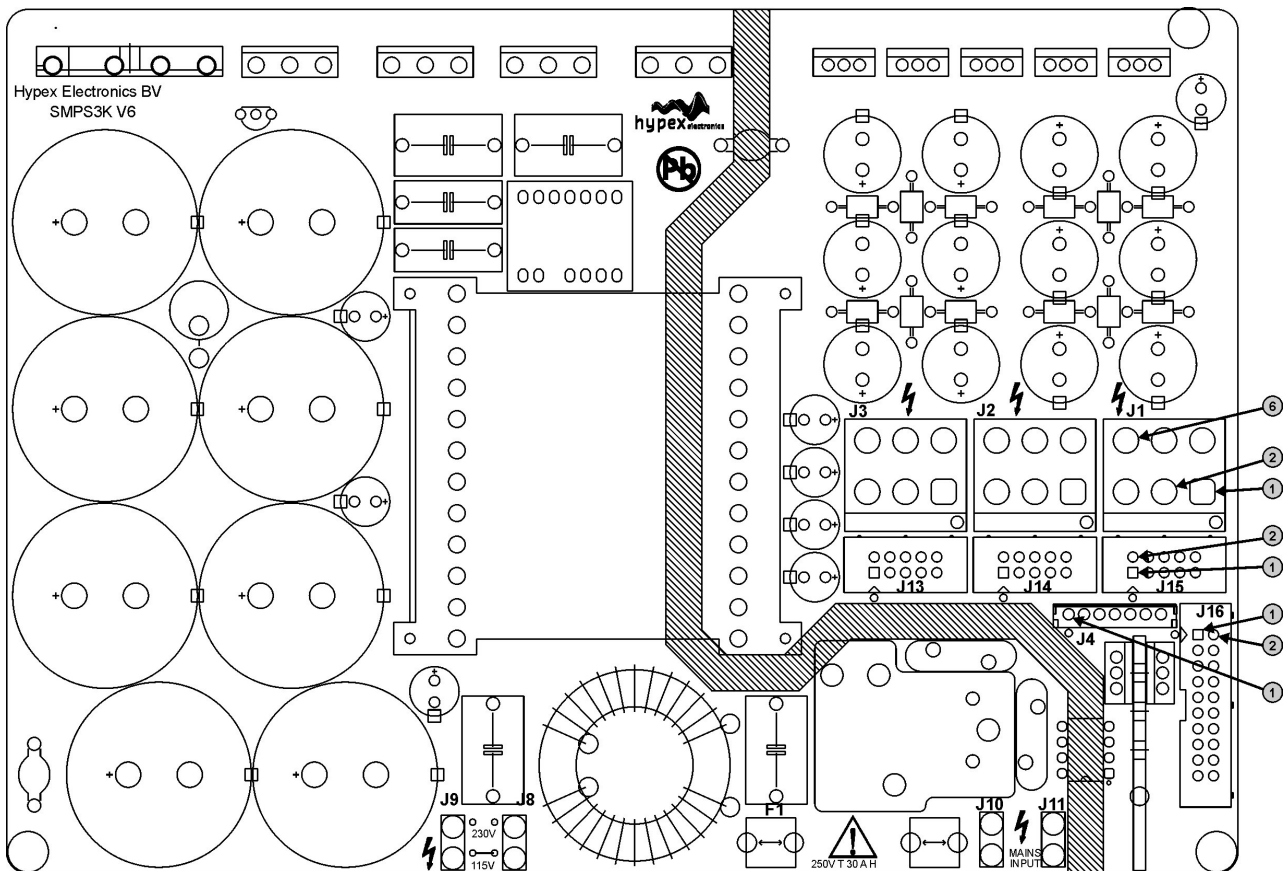


Figure 1: Connector pinning SMPS3K.

### 8.1 J1, J2 & J3: supply connection

Connector type: JST ([www.jst.com](http://www.jst.com)) B06P-VL. Matching cable part: VLP-06V.

Pin	Function
1	Positive Bootstrap Driver Voltage (VdrP) <sup>1)</sup>
2	Positive Output Voltage (Vcc)
3	Output Ground
4	Negative Bootstrap Driver Voltage (VdrN) <sup>1)</sup>
5	Negative Output Voltage (Vee)
6	Output Ground

### 8.2 J10 & J11: Mains Input

Connector type: 6,3x0,8 FASTON<sup>®</sup> tab.

Pin	Function
J10, J11	Mains Input

### 8.3 J8 & J9: Mains Voltage Input Selection

Connector type: 6,3x0,8 FASTON<sup>®</sup> tab.

Pin	Function
J8, J9	Not Connected = 230Vac Mains Connected = 115Vac Mains

## High Efficiency High Power Audio SMPS

### 8.4 J4: Aux & Control

Connector type: JST ([www.jst.com](http://www.jst.com)) B7B-VH. Matching cable part: EHR-7

Pin	Function
1	SMPS Standby
2	Amplifier Standby
3	Unregulated Positive Auxiliary Output Voltage
4	NC
5	Ground
6	NC
7	Unregulated Negative Auxiliary Output Voltage

### 8.5 J13, J14 & J15: 3 x UcD700/2k compatible input/control interface.

Connector type: 2x5Pin Boxheader

Pin	Function
1	Positive Regulated Auxiliary Output Voltage (+12V)
2	Negative Regulated Auxiliary Output Voltage (-12V)
3	Ground
4	Amplifier Ready
5	Clip
6	Auto Amplifier Enable
7	Audio Input (Hot)
8	Audio Input (Cold)
9	Ground
10	DC Error Input

### 8.6 J16: Customer Application Interface

Connector type: 2x10Pin Boxheader

Pin	Function
1	Input Signal Amp connected to J15 (Cold)
2	Input Signal Amp connected to J15 (Hot)
3	Input Signal Amp connected to J14 (Cold)
4	Input Signal Amp connected to J14 (Hot)
5	Input Signal Amp connected to J13 (Cold)
6	Input Signal Amp connected to J13 (Hot)
7	Ground
8	Clip indication Amp connected to J15
9	Clip indication Amp connected to J14
10	Clip indication Amp connected to J13
11	Amplifiers Ready
12	Amplifiers Standby Input
13	Power supply Standby
14	AC-Mains Detection (open collector)
15	Unregulated Positive Aux voltage (+23V)
16	Unregulated Negative Aux voltage (-23V)
17	Ground
18	Voltage sensing negative supply rail
19	Voltage sensing positive supply rail
20	Voltage sensing gate driver supply

## High Efficiency High Power Audio SMPS

### 8.7 Input Signal Routing

Each of the three input signal pairs are routed directly from J16 to J13-J15. This enables a simple connection between the SMPS3k and the user application.

### 8.8 Clipping Indication

In the event of a clipping amplifier its respective pin on J16 is pulled low by means of an open collector output. This signal may be used to drive limiter circuitry or an LED clip indicator.

### 8.9 Amplifier Ready

If one of the connected amplifiers enters error-state, due to a permanently shorted output or an overvoltage situation, this output is pulled low by means of an open collector output.

### 8.10 Amplifier Standby Input Characteristics

Applying an external DC voltage to the amplifier standby pin will put the amplifier in standby. The connected amplifier must be connected to Auto Amplifier Enable, described below, in order to use this option.

Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J16:12	input	0		Vcc	Vdc	

### 8.11 SMPS Standby Input Characteristics

Applying an external DC voltage to this input will put the SMPS in standby. Both main and auxiliary output voltages will drop gradually. Removing the standby voltage will result in a normal soft started start-up of the SMPS3K. Putting the SMPS in standby also automatically release the Auto Amplifier Enable line guarantying pop-free shut down of the connected UcD Amplifier.

Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J16:13	input	3,3		12	Vdc	

### 8.12 Regulated Auxiliary Output Characteristics

The SMPS3K provides Regulated Auxiliary Output Voltages that are only available to the connected UcD amplifiers through connectors J13, J14 & J15.

Item	Type	Min	Typ	Max	Unit	Notes
Positive DC voltage pin10	output		12		Vdc	
Negative DC voltage pin9	output		12		Vdc	

### 8.13 Output Voltage Characteristics

Item	Type	Min	Typ	Max	Unit	Notes
Positive DC voltage	Output		85		Vdc	<sup>1)</sup> <sup>2)</sup>
Negative DC voltage	Output		85		Vdc	<sup>1)</sup> <sup>2)</sup>

**Note 1:** Output voltage is fixed by design and proportional to the mains line voltage.

**Note 2:** These outputs are fully long term shortcut protected: outputs to ground, output to output.

### 8.14 Output Grounds Characteristics

The Output Ground reference. Main Output Ground and Auxiliary Output Ground are connected together on the board.



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### 8.15 Driver Voltage Output Characteristics

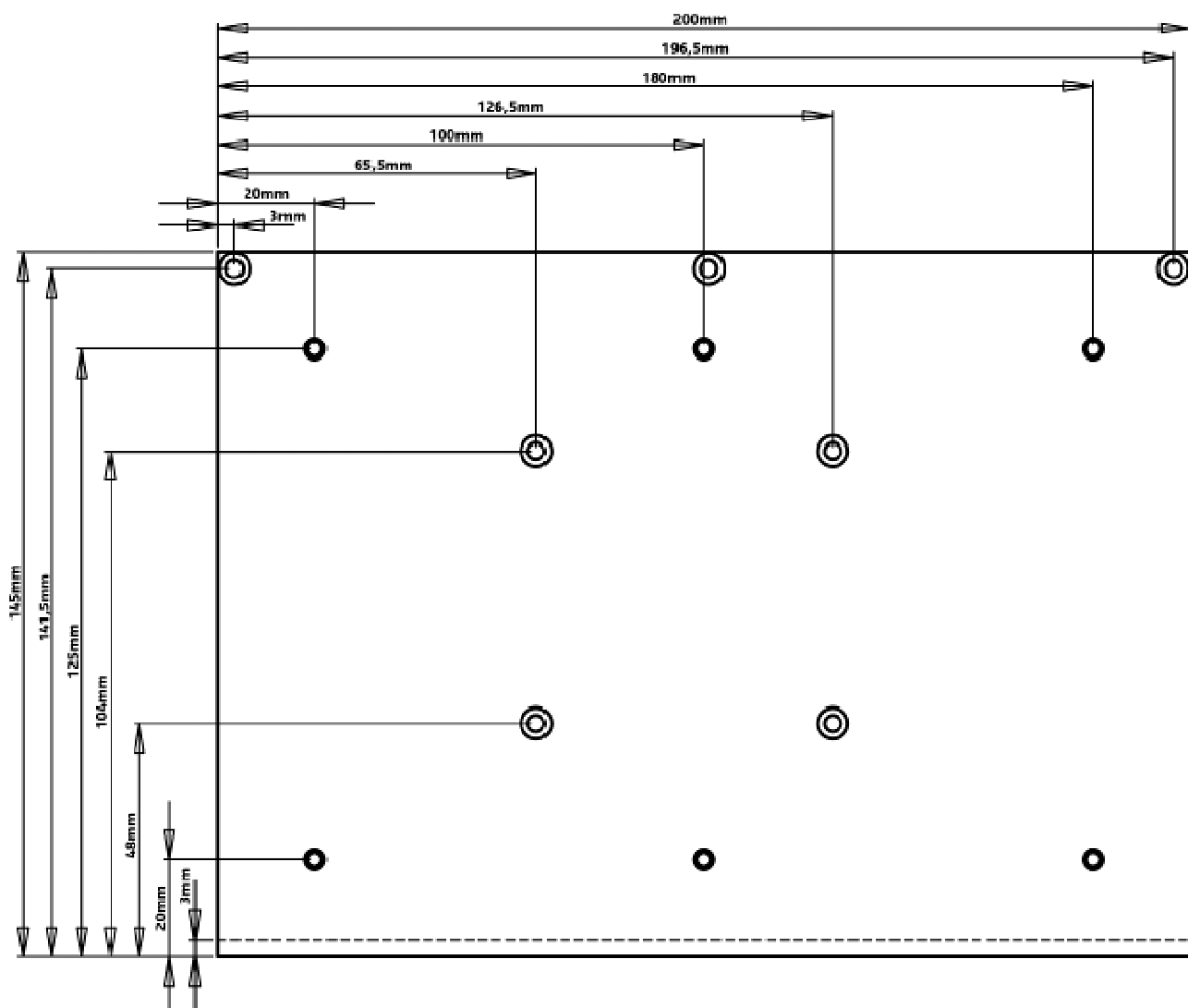
The SMPS3k provides a regulated +15V supply voltage which is used to power the driver circuit of a UcD700 or UcD2k series amplifier. These amplifiers need the 15V supply voltage referred to its negative supply rail (Vee). In order to achieve this, the “Negative Bootstrap Driver Voltage” (VdrN) must be connected to its negative supply rail (Vee) at the amplifier side. The “Positive Bootstrap Driver Voltage” (VdrP) then must be connected to the UcD700/UcD2k series Vdr supply input.

### 8.16 Rail Voltage sensing

Both the positive and negative supply rail and the VDR rail are connected to J16 via a 100k 0805 resistors. This enables the user to interface these rails with a microcontroller and measure its values.

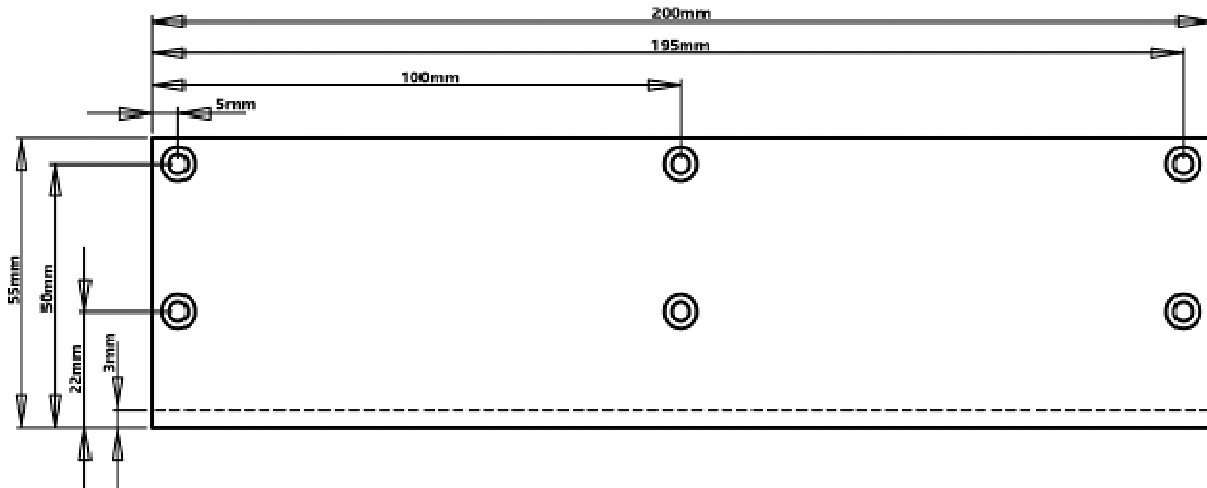
## 9 Mounting Dimensions

### 9.1 Bottom view L-profile



## High Efficiency High Power Audio SMPS

### 9.1.1 Back view L-profile



**DISCLAIMER:** This product is designed for use in sound reproduction equipment in conjunction with Hypex amplifier modules. No representations are made as to fitness for use in other applications. Except where noted otherwise any specifications given pertain to this subassembly only. Responsibility for verifying the performance, safety, reliability and compliance with legal standards of end products using this subassembly falls to the manufacturer of said end product.

**LIFE SUPPORT POLICY:** Use of Hypex products in life support equipment or equipment whose failure can reasonably be expected to result in injury or death is not permitted except by explicit written consent from Hypex Electronics BV.

Revision	PCB Version	Description	Date
R1	SMPS3k V1	Initial Draft. Applicable to SMPS3K V1.	08.06.2009
R2	SMPS3k V3	Changes with regard to output connectors. DC-error reset within 3sec. instead of 30mins. Improved EMI performance. VDR fully isolated to output connector.	05.10.2010
R3	SMPS3k V3	VDR connection clarified in text.	11.02.2011
R4	SMPS3k V4	Connector J4 added	19.08.2011
R5	SMPS3k V5	Pinout updated	13.03.2012
R6	SMPS3k V6	Format changed	14.01.2013