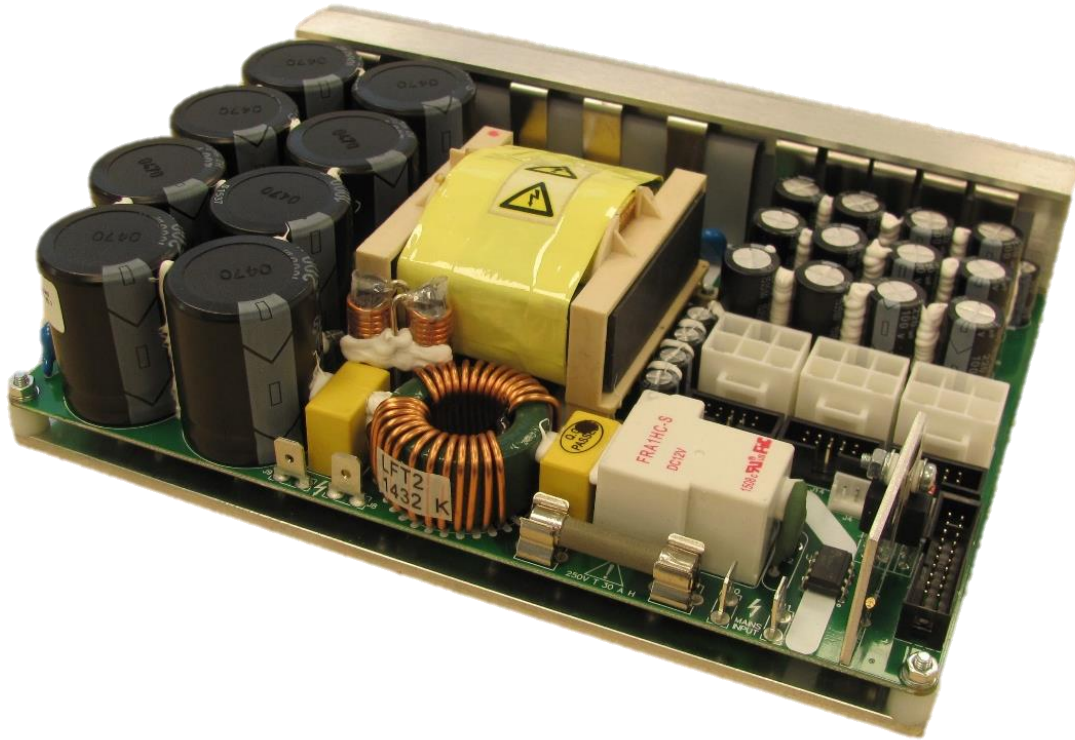


## High Efficiency High Power Audio SMPS



### Highlights

- High efficiency
- Selectable input voltage range
- Low EMI
- 2 variants available
- Fixed output voltage

### Features

- Advanced over current protection
- Remote controlled operation
- Low weight: 1475gr.
- Compact design: 200 x 145 x 55mm

### Applications

- Supply for single or multiple amplifiers of the UcD and NCore ranges
- Active loudspeakers

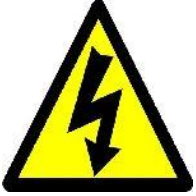
### Introduction

The SMPS3K is a high efficiency Safety Class 1 switch mode power supply specifically designed for use with our range of Ncore and 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 a symmetrical auxiliary output and a control circuit directly interfacing with our range of UcD/NCore amplifier modules. The supply is triggered for normal operation or latched off in case of critical fault via 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.

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## 1 Safety precautions

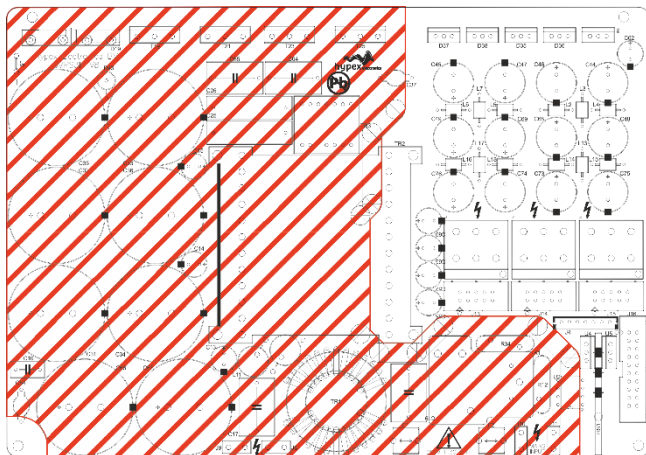


**This module operates at mains voltage and carries hazardous voltages at accessible parts. These parts may never be exposed to inadvertent touch. Observe extreme care during installation and never touch any part of the unit while it is connected to the mains. Disconnect the unit from the mains and allow all capacitors to discharge for 10 minutes before handling it.**

**This product has no user-serviceable parts.**

This is a Safety Class 1 device. When mounting the module in an enclosure, a minimum safety distance of 3mm from the SMPS to all possible conducting parts must be ensured to keep compliance with Safety Class 1. All parts enclosed by the red line carry hazardous voltages. This includes parts on the top and the bottom of the board.

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 PCBA to the chassis without the need for additional insulating material. If the enclosure is limited in height, the L bracket can be omitted. An insulating sheet with a minimum thickness of 0.4mm, protruding a minimum of 3mm from the SMPS3K's footprint must be installed below the SMPS if shorter spacers are used to mount the SMPS to keep compliance with safety class 1.



This symbol indicates the presence of hazardous voltages at accessible conductive terminals on the board. Parts that are not highlighted in red may also carry voltages in excess of 200 Vdc!

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

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the application.
7. Only use attachments/accessories specified or approved by the manufacturer.
8. Unplug this apparatus during lightning storms or when unused for long periods of time.
9. 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.
10. Don't run any cables across the top or the bottom of the module. Apply fixtures to cables to ensure that this is not compromised.
11. Observe a minimum clearance of 6mm with all possible conducting parts (housing etc.).
12. Natural convection should not be impeded by covering the module (apart from the end applications housing).
13. This product is to be used with Hypex amplifier modules only.
14. Before using this product, ensure all cables are correctly connected and the power cables are not damaged. If you detect any damage, do not use the product.
15. Changes or modifications not expressly approved by Hypex Electronics will void compliance and therefore the user's authority to operate the equipment.
16. Service or modifications by any person or persons other than by Hypex Electronics authorized personnel voids the warranty.

## 2 The SMPS3K Series

The SMPS3K series is a range of Switch Mode Power Supplies. In the next table there is an overview of the different models, their output voltages and application.

Model	Main rails output	For use with amplifiers (examples)
SMPS3KA400	2x 63Vdc	UcD250LP, UcD400 Series, NC400 DIY, NC500 oem
SMPS3KA700	2x 85Vdc	UcD700 Series, NC500 oem, NC1200, UcD2K

The maximum number of modules which can be connected to the SMPS3k is limited by the output power of the SMPS. Please refer to the amplifier's datasheet for more information.

### 2.1 Half-bridge amplifiers (UcD400/UcD700)

The SMPS3K is intended to power our range of high power amplifier modules. As a result this SMPS product does not feature the 2 quadrant operation as most of our other SMPS products do. Therefore 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 and UcD400 modules when used in the frequency range below 100Hz. A workaround for this could be using the UcD700/UcD400 in bridge mode, or reversing phase for half of the modules.

## 3 Electrical Specifications

### 3.1 Power Specifications

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
High Line Input Voltage	-	$V_B$	180	230	264	Vac	<sup>1)</sup>
Low Line Input Voltage	With Low Line jumper placed	$V_{B,FP}$	90	115	132	Vac	<sup>1)</sup>
Line Input Frequency	-	f	47		63	Hz	<sup>1)</sup>
Fuse rating	250Vac, slow blow			30		A	<sup>2)</sup>

**Note 1:** Operation beyond these limits may result in irreversible damage.

**Note 2:** If fuse is blown, please consult a skilled technician to inspect your module. If applicable, replace the fuse with same type and rating.

### 3.2 General Performance Data

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Output Voltage Main	A400, symmetric	$V_{OUT}$	2x49	2x63	2x72	Vdc	<sup>1), 2)</sup>
	A700, symmetric	$V_{OUT}$	2x66	2x85	2x97	Vdc	<sup>1), 2)</sup>
Output Power Main		$P_{OUT}$		3000		W	
Output Voltage Vaux	A400, symmetric	$V_{AUX}$	2x15.5	2x20	2x23	Vdc	<sup>1)</sup>
	A700, symmetric	$V_{AUX}$	2x18	2x23	2x26	Vdc	<sup>1)</sup>
Output Current Vaux	All versions, per rail	$I_{AUX}$	-	-	500	mA	
Output Voltage $V_{DR}$	A400	$V_{OUT,Vdr}$	-	15.6	-	Vdc	
	A700	$V_{OUT,Vdr}$	-	15	-	Vdc	
Output Current $V_{DR}$	All versions	$I_{OUT,Vdr}$	-	-	500	mA	
Output Voltage Regulated	All versions	$V_{AUX,REG}$		2x12		Vdc	<sup>3)</sup>
Output Current Regulated	All versions, per rail	$I_{AUX,REG}$	-	-	100	mA	
In-rush current	20 $\Omega$ In-rush NTC, worst-case	$I_{Inrush}$			19	A	
Efficiency	Full power	$\eta$	93			%	
Power consumption	Depending on load	$P_{max}$			3800	W	
Idle Losses	230 Vac, 50 Hz	$P_0$	-	15	-	W	
Standby Power	Power consumption in standby	$P_{standby}$		450		mW	
Switching frequency		$F_{SW}$	80	100	120	kHz	

**Note 1:** Output voltage is proportional to the mains line voltage (Min@180Vac, Typical@230Vac, Max@264Vac).

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

**Note 3:** Regulated output voltage is required for the connected amplifiers, external use is not recommended in multi-amplifier applications.

### 3.3 Timing Specifications

These timings are measured at room temperatures, approximately 21°C, 230Vac.

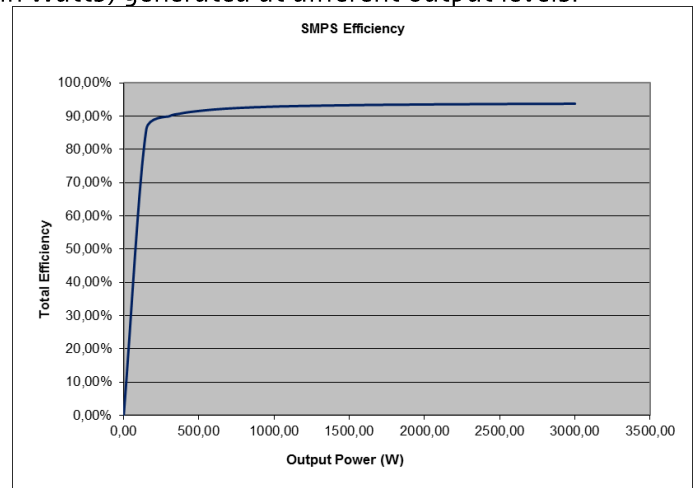
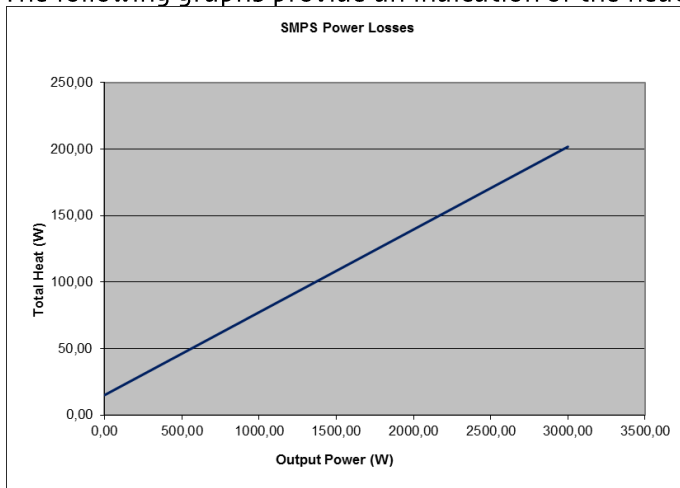
Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Switching start up delay	Time to when all power supplies are within operational limits			TBD		ms	
Output delay	Time delay to signal			TBD		ms	
Shutdown delay	Supply failure or Standby pin			TBD		ms	

## 4 Environmental Specifications

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Ambient Temperature	Storage		-25	-	70	°C	
	Operation	$T_{amb}$	0	-	50	°C	
Heat-sink Temperature		$T_{h,max}$			95	°C	
Humidity	Max 85 percent relative humidity, non-condensing.						

### 4.1 Heat dissipation

The following graphs provide an indication of the heat (in Watts) generated at different output levels.



## 5 IO Specifications

### 5.1 SMPS Stand-by

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-start of the SMPS3K. Putting the SMPS in standby also automatically releases the Amp Enable line, guarantying pop-free shut down of the connected UcD/NCORE Amplifier.

Parameter	Conditions	Symbo l	Min	Typ	Max	Unit	Note
SMPS in standby	Logic High level		3,3	-	5	Vdc	<sup>1)</sup>
SMPS enabled	Logic Low level		-	-	0,8	Vdc	

**Note 1:** The current (A) drawn can be calculated as follows:  $(V_{pin} - 1.2) / 270$

### 5.2 Amp Standby

Applying an external DC voltage to the Amp Standby pin will put the amplifier in standby. The connected amplifier must be connected to Amp Enable in order to use this option.

Parameter	Conditions	Symbo l	Min	Typ	Max	Unit	Note
Amplifier in standby	Logic High level		3,3	-	$V_{AUX}$	Vdc	<sup>1)</sup>
Amplifier enabled	Logic Low level		-	-	0,8	Vdc	

**Note 1:** The current (A) drawn can be calculated as follows:  $(V_{pin} - 0.7) / 47000$

### 5.3 DC-Error

In the event of a critical failure occurring in the connected amplifier, the SMPS3K needs to be switched off rapidly. The SMPS3K provides a DC Error Input designated for each connected UcD OEM/NCORE series amplifiers. The DC Error Input is latched and will not auto-recover. To reset the DC Error the module must be disconnected from mains for at least 1 minute to allow the primary capacitors to drain.

Parameter	Conditions	Symbo l	Min	Typ	Max	Unit	Note
No error condition	Use open collector		-	-	-	Vdc	<sup>1)</sup>
DC Error	Pull pin to Gnd		-	Gnd	-	Vdc	<sup>1), 2)</sup>

**Note 1:** DC-Error must be pulled to ground to activate. Hypex amplifier modules use open collector output (DC-Error pin) to achieve this.

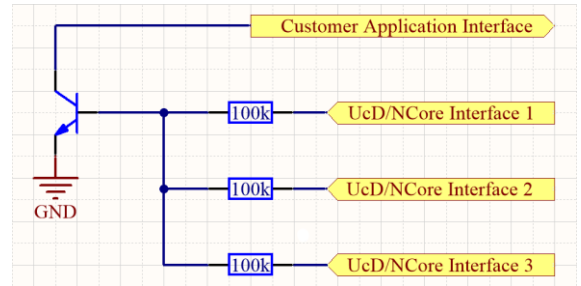
**Note 2:** The current (A) can be calculated as follows:  $(V_{aux} - 1.2) / 1000$

### 5.4 Amplifier Ready Bus

The Amplifier Ready Bus consists of 3 inputs and 1 output pin.

The inputs are part of the UcD/NCore Interface and will work with our compatible Ucd/NCore amplifier modules.

The output is routed to the Customer Application Interface. 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.



Parameter	Conditions	Symbo l	Min	Typ	Max	Unit	Note
<b>Amplifier not Ready</b>	Logic High level Input		3,3	-	12	Vdc	<sup>1)</sup>
<b>Amplifier Ready</b>	Logic Low level Input		-	-	0,8	Vdc	

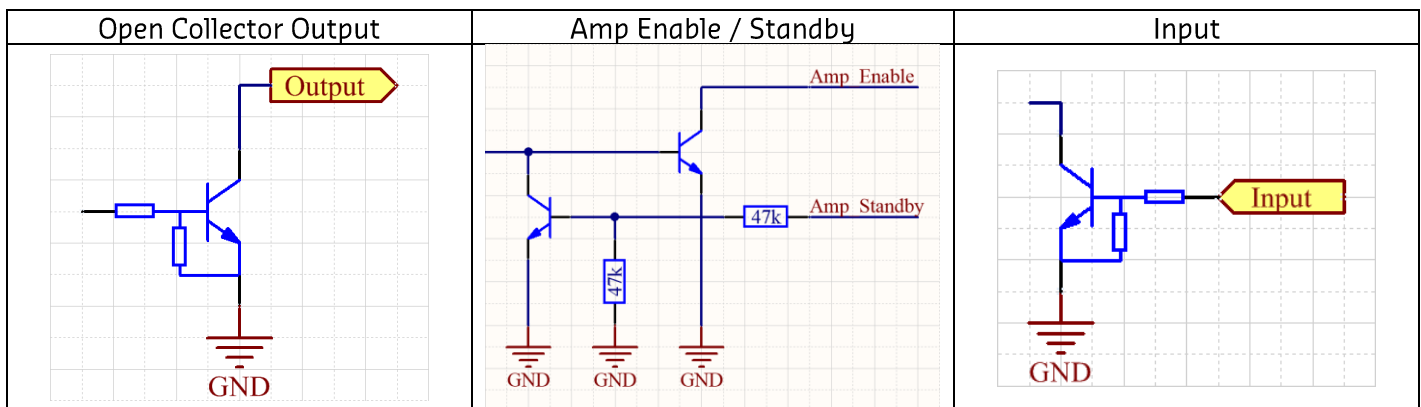
**Note 1:** The current (A) drawn can be calculated as follows:  $(V_{pin} - 0.7) / 100000$

Parameter	Conditions	Symbo l	Min	Typ	Max	Unit	Note
<b>Collector voltage</b>	Open collector output		-	-	50	V	
<b>Collector current</b>	Open collector output		-	-	100	mA	

### 5.5 Amp Enable

When the enable-line of a UcD/NCore series amplifier is connected to this pin, the amplifier will be enabled and disabled automatically when the SMPS3K is switched on and off. By doing so, it prevents unwanted audio artefacts during powerup and powerdown.

Parameter	Conditions	Symbo l	Min	Typ	Max	Unit	Note
<b>Collector voltage</b>	Open collector output		-	-	50	V	
<b>Collector current</b>	Open collector output		-	-	100	mA	



### 5.6 Bootstrap Driver Voltage ( $V_{DR}$ )



The SMPS3K provides a regulated Bootstrap Driver Voltage ( $V_{DR}$ ) which is used to power the driver circuit of an UcD or NCore series amplifier. Most Hypex amplifier modules need the  $V_{DR}$  voltage referenced to the negative supply rail (HV-). In order to achieve this, the  $V_{DR-}$  should be connected to the main negative supply rail (HV-) at the amplifier side. The  $V_{DR+}$  must be connected to the UcD/NCore series  $V_{DR}$  supply input.

### 5.7 Output Ground Characteristics

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

### 5.8 Rail Voltage Sensing

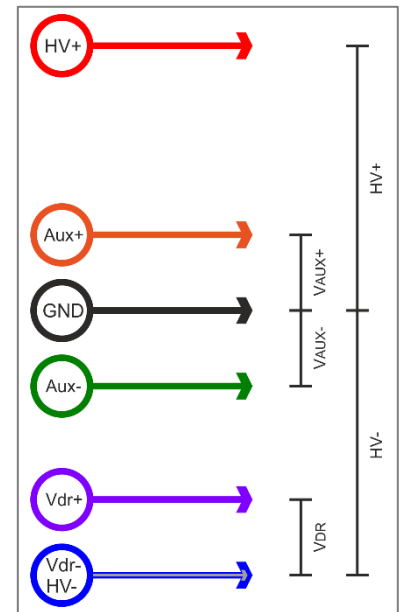
Both the positive and negative supply rail and the VDR rail are connected to the Customer Application Interface via 100k 0805 resistors. This enables the user to interface these rails with a microcontroller and measure its values.

### 5.9 Amp Clip

The Amp Clip pins in the Customer Application Interface are a direct pass-through from the respective UcD/NCore Interface. Therefore the IO characteristics of these pins are equal to these on the connected amplifier.

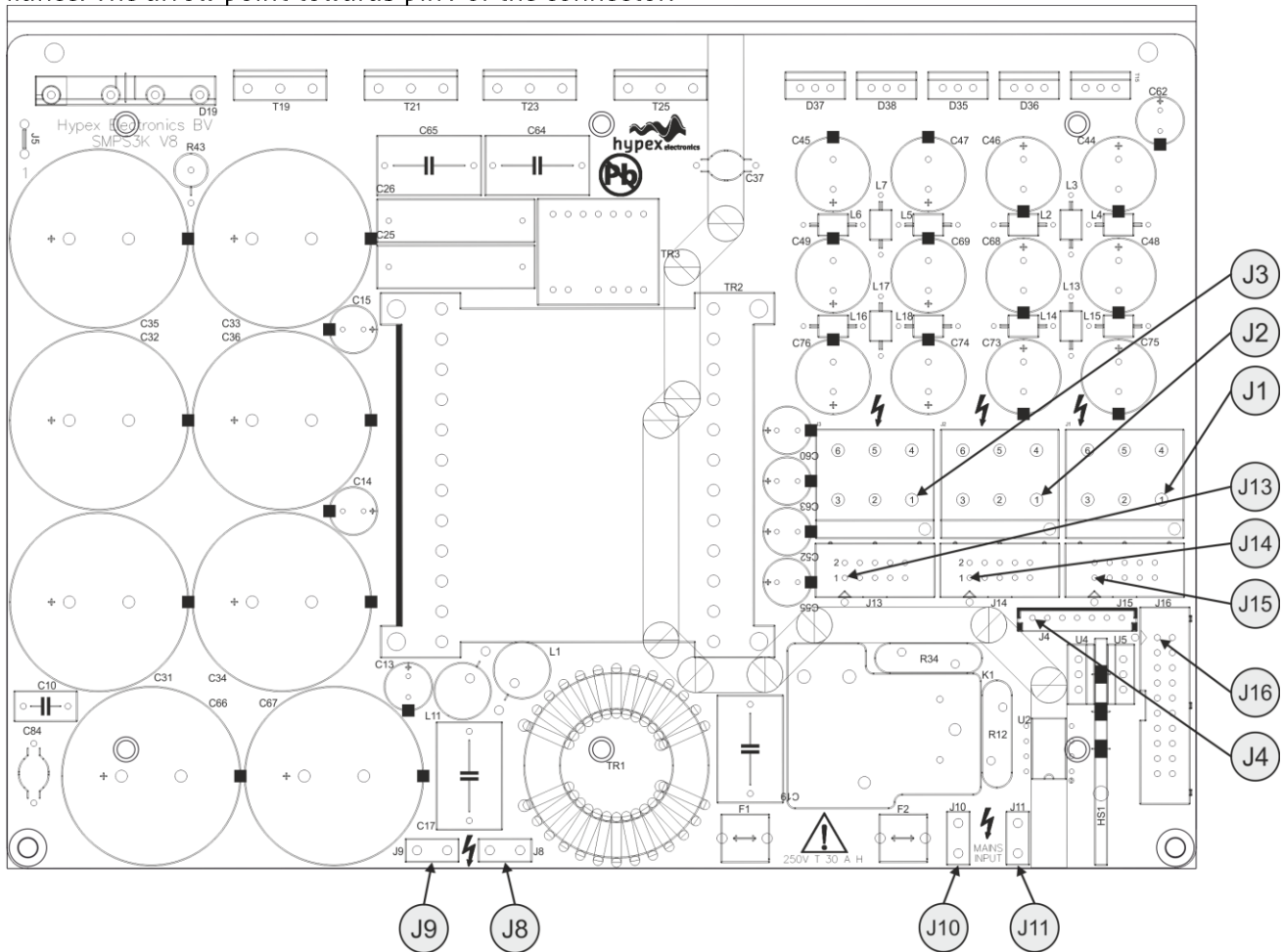
### 5.10 Audio Pass-through

The SMPS3K supports the direct pass-through of balanced audio signals from the Customer Application Interface to the respective UcD/NCore Interface. By doing so the customer application can be connected to the power stage using a single interface cable.



## 6 Connector Pinouts

This chapter describes the functional connectors of the power supply module. A connector not stated in this chapter is only used for production or quality control and must remain unconnected in the end user appliance. The arrow point towards pin1 of the connector.



### 6.1 Main output connector

The following table is applicable to J1, J2, and J3.

Pin	Direction	Function	Remarks
J1.1	Output	$V_{DR+}$	Positive bootstrap driver voltage
J1.2	Output	HV+	Positive supply rail
J1.3	-	GND	Ground
J1.4	Output	$V_{DR-}$	Negative bootstrap driver voltage
J1.5	Output	HV-	Negative supply rail
J1.6	-	GND	Ground

**Connector type equivalent:** B06P-VL.

**Matching cable part:** VLP-06V.

### 6.2 AC Connector Specification

Pin	Direction	Function	Remarks
J10.1	Input	Mains input	6,3x0,8 mm FASTON® tab
J11.1	Input	Mains input	6,3x0,8 mm FASTON® tab

### 6.3 Mains Voltage Selection

Pin	Direction	Function	Remarks
J8, J9	Jumper	Input Voltage Select	Open = 230Vac; Closed = 115Vac.

**Connector type equivalent:** 6,3x0,8 mm FASTON® tab

### 6.4 UcD/NCore Interface

The following table is applicable to J13, J14, and J15.

Pin	Direction	Function	Remarks
J13.1	Output	$V_{AUX\_REG}$	Positive rail
J13.2	Output	$V_{AUX\_REG}$	Negative rail
J13.3	-	GND	Ground
J13.4	Input	Amp Ready	Amplifier Ready Bus Input <sup>1)</sup>
J13.5	Input	Amp Clip	Pass-through to J16 <sup>1)</sup>
J13.6	Output	Amp Enable	Amplifier enable
J13.7	Output	Audio Output (Hot)	Pass-through from J16 <sup>1)</sup>
J13.8	Output	Audio Output (Cold)	Pass-through from J16 <sup>1)</sup>
J13.9	-	GND	Ground
J13.10	Input	DC Error	

**Connector type equivalent:** T821110A1S100CEU

**Contact material:** Brass, gold flash over nickel

**Note 1:** See Chapter 5, IO Specifications for more information

### 6.5 Aux Voltage and PS Control

Pin	Direction	Function	Remarks
J5.1	Input	SMPS Standby	
J5.2	Input	Amp Standby	
J5.3	Output	$V_{AUX}$	Positive Auxiliary Output
J5.4	-	NC	Do not connect
J5.5	-	GND	Ground
J5.6	-	NC	Do not connect
J5.7	Output	$V_{AUX}$	Negative Auxiliary Output

**Connector type:** B7B-EH-A(LF)(SN).

**Matching cable part:** EHR-7.

## 6.6 Customer Application Interface

Pin	Direction	Function	Remarks
J16.1	Input	Audio Input (Cold)	Pass-through to J15
J16.2	Input	Audio Input (Hot)	Pass-through to J15
J16.3	Input	Audio Input (Cold)	Pass-through to J14
J16.4	Input	Audio Input (Hot)	Pass-through to J14
J16.5	Input	Audio Input (Cold)	Pass-through to J13
J16.6	Input	Audio Input (Hot)	Pass-through to J13
J16.7	-	GND	Ground
J16.8	Output	Amp Clip	Pass-through from J15
J16.9	Output	Amp Clip	Pass-through from J14
J16.10	Output	Amp Clip	Pass-through from J13
J16.11	Output	Amplifiers Ready	Amplifier Ready Bus Output
J16.12	Input	Amplifier Standby	Amplifier Standby Input
J16.13	Input	SMPS Standby	Power Supply Standby
J16.14	Output	AC Detection	AC-Mains Detection (open collector)
J16.15	Output	Vaux+	Positive Output Voltage Vaux
J16.16	Output	Vaux-	Negative Output Voltage Vaux
J16.17	-	GND	Ground
J16.18	Output	Voltage sensing HV-	Inline 0805 100K resistor
J16.19	Output	Voltage sensing HV+	Inline 0805 100K resistor
J16.20	Output	Voltage sensing VDR	Inline 0805 100K resistor

## 7 Typical 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.  $T_a = 25^\circ\text{C}$ . Connected amplifier: 2 x UcD2K,  $f = 1\text{ kHz}$ .

SMPS3K is horizontally mounted in free air without additional external cooling. The SMPS3K was preheated at  $1/8P_o$  (2 x 190W@ 1 kHz into 4 Ohm amplifier load).

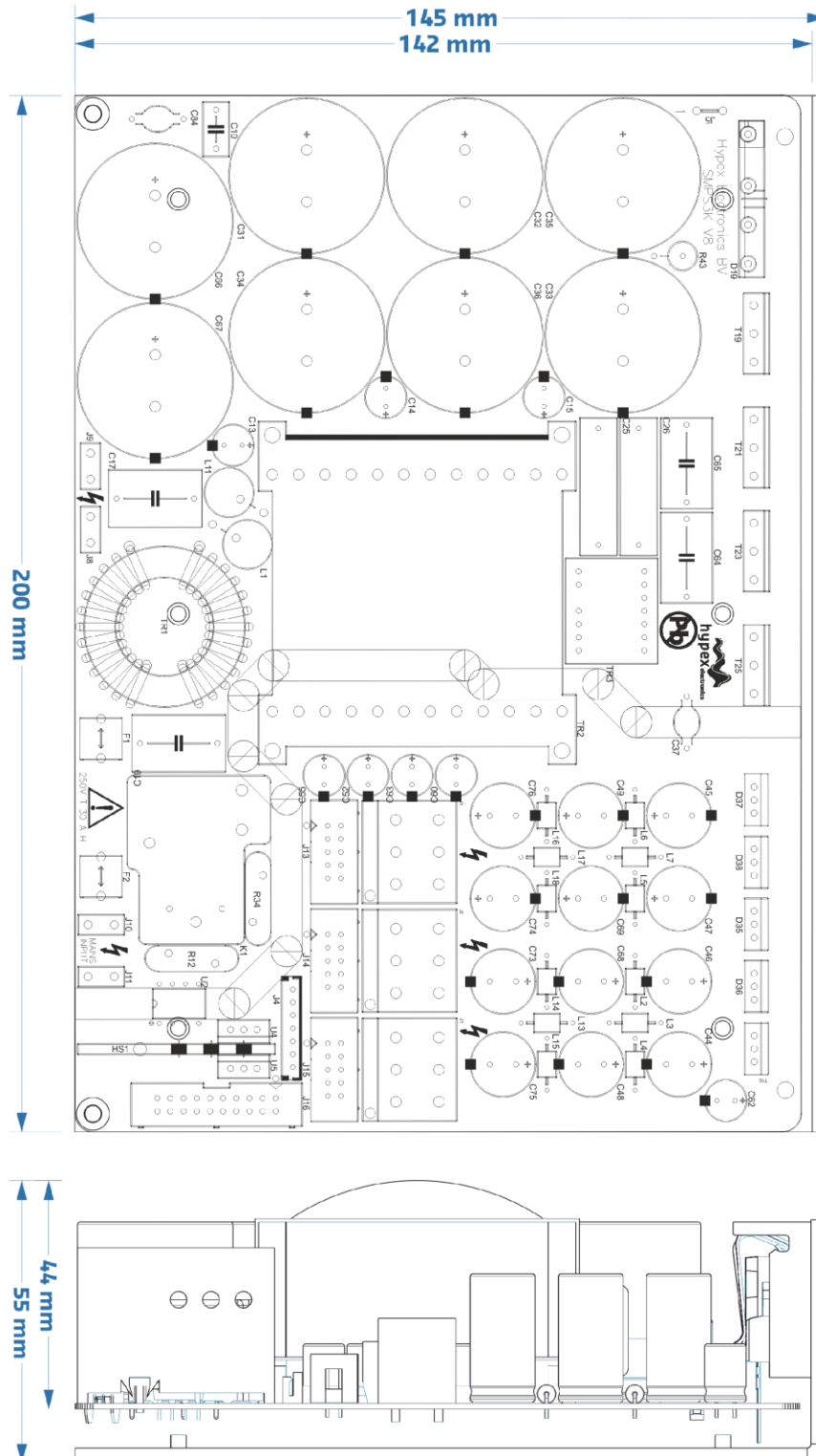
Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Amplifier output power for 10 sec. until $T_{\text{sink}} = 95^\circ\text{C}$	Load = 4Ω 230Vac/50Hz	$P_o$	-	1200		W	
Continuous output power. $T_{\text{sink}}$ stabilized at 95°C	Load = 4Ω 230Vac/50Hz	$P_o$	-	1000		W	

## 8 Dimensions and Drill pattern

Maximum allowed protruding depth inside each spacer is 4mm. Spacer threads are M3.

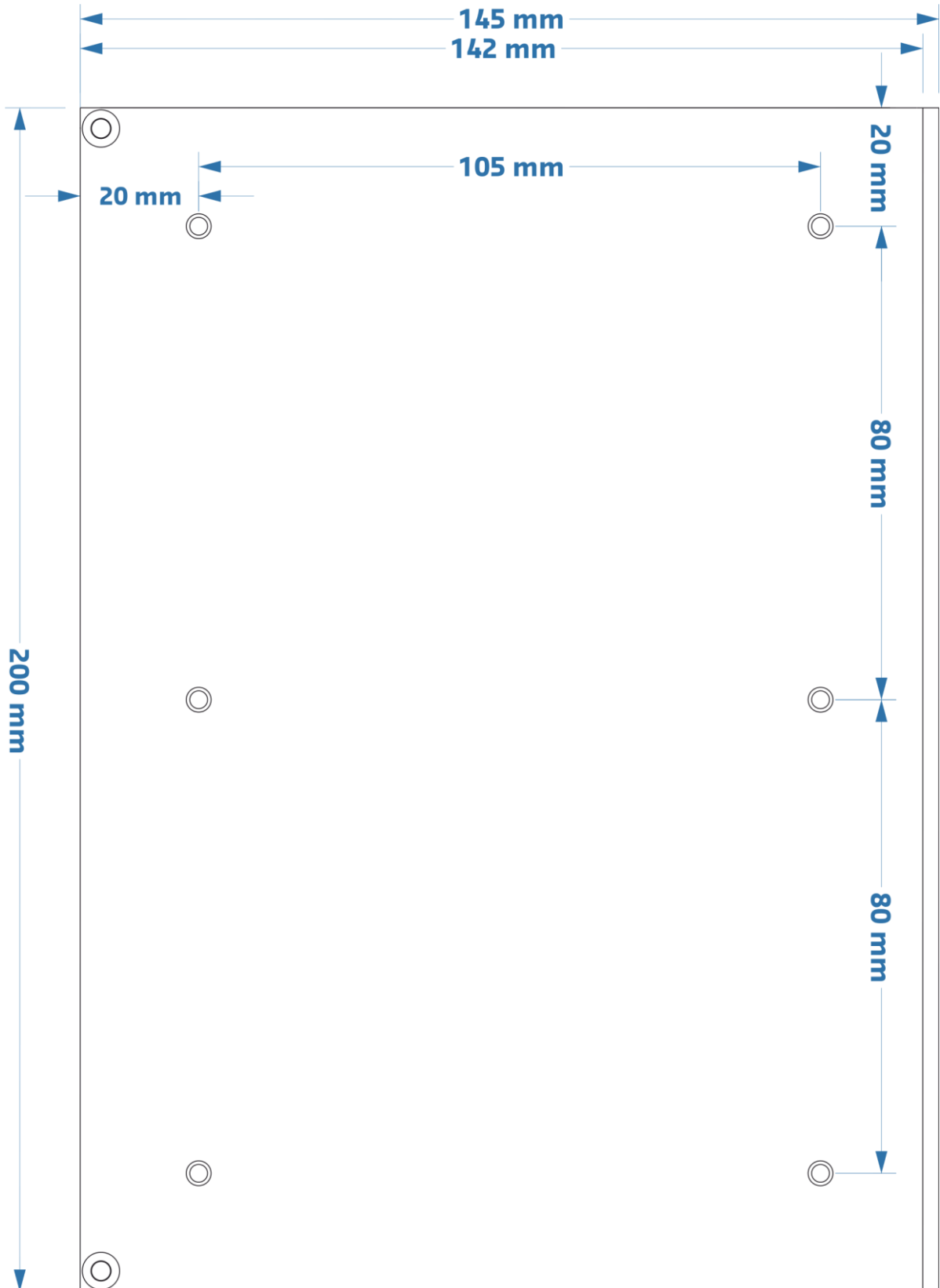
### 8.1 Bottom view, L-profile dimensions

Note that the image below is not a 100% scale. Assembly version V7 and higher. For older dimensions, refer to older datasheet.



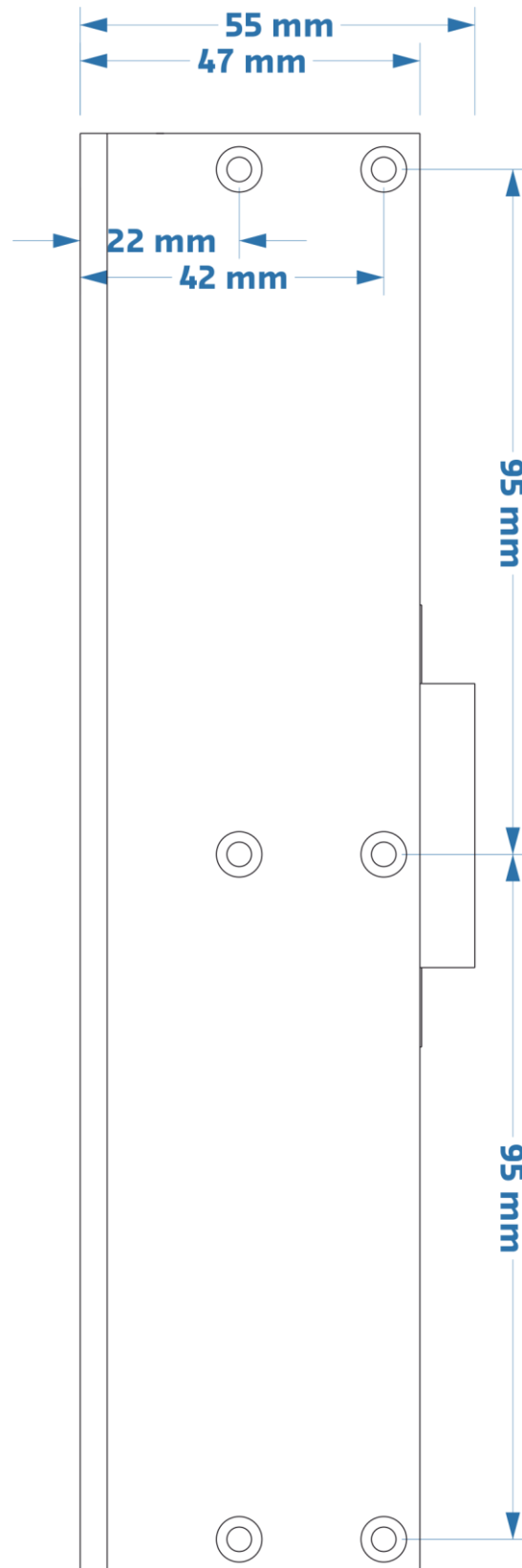
### 8.2 Bottom view, L-profile

If printed correctly (scale 100%, A4), the scale of the image below should be 1:1. You may use it as a model to drill holes in your casing. Please verify before drilling!



### 8.3 Back view, L-profile

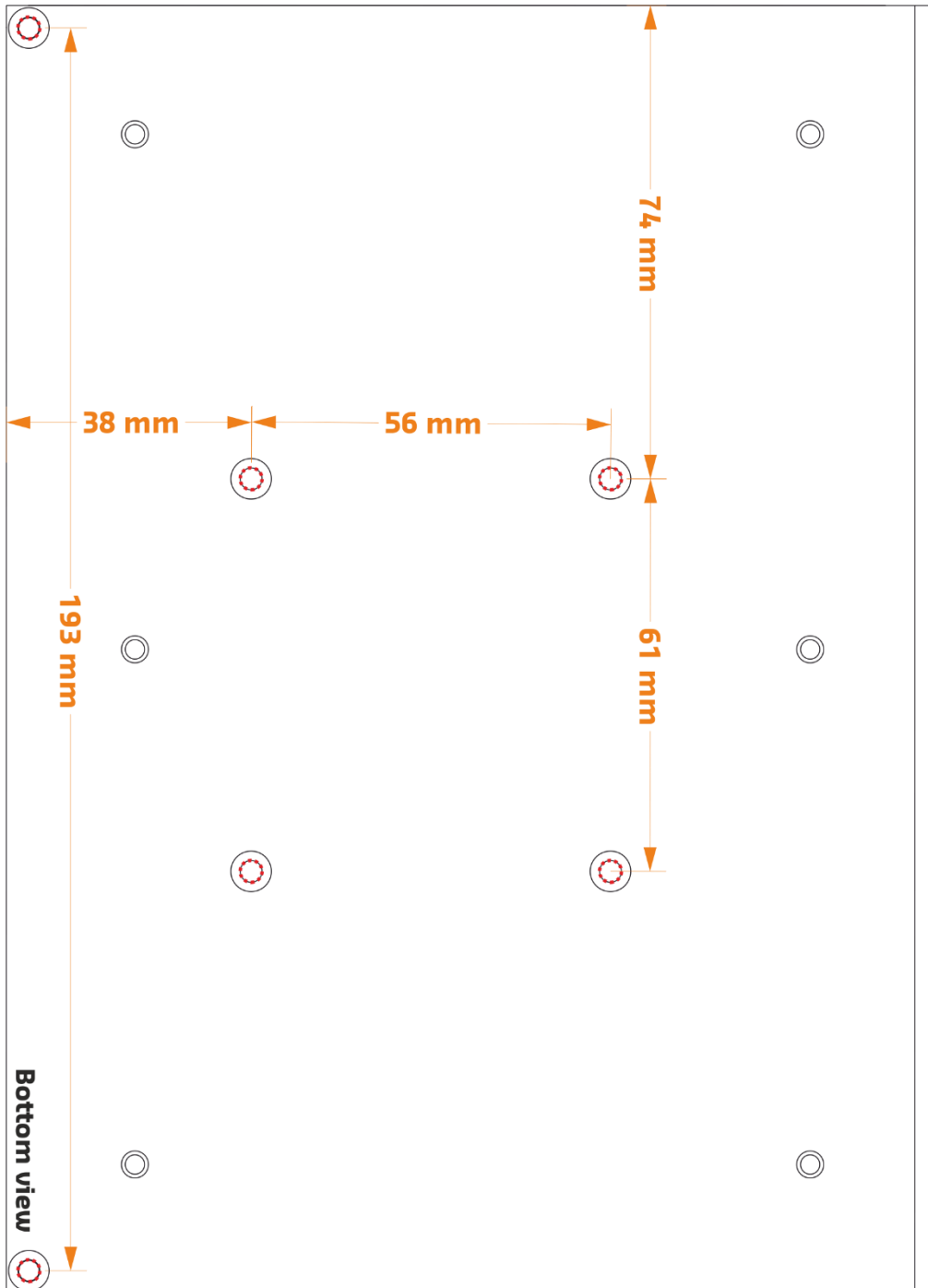
If printed correctly (scale 100%, A4), the scale of the image below should be 1:1. You may use it as a model to drill holes in your casing. Please verify before drilling!





### 8.4 Bottom view, without L-profile

If the Lshaped profile is omitted, additional mounting holes are required. If printed correctly (scale 100%, A4), the scale of the image below should be 1:1. You may use it as a model to drill holes in your casing. Please verify before drilling!



## 9 Revisions

Document 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
R7			
R8	SMPS3k V7	SMPS3kA400 added	18.02.2014
R9	SMPS3k V7	Auxiliary output figures corrected	02.02.2015
R10	SMPS3k V7	Vdr output figures corrected Dimensions changed (height)	04.06.2015
V8D1	SMPS3K V8.1	- New datasheet format	16.11.2015

## 10 Disclaimer

**All products, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.**

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