

## High Efficiency High Power Audio SMPS

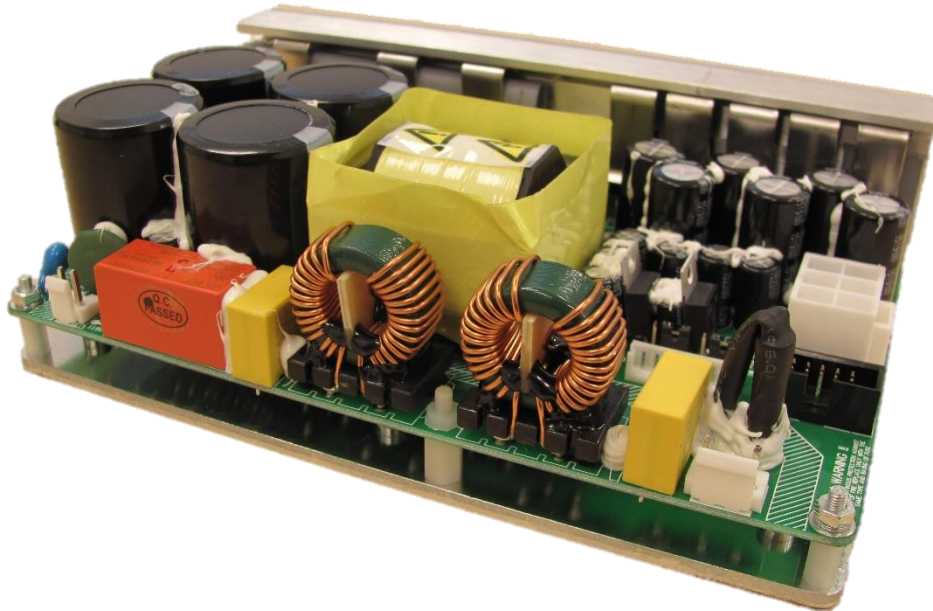


Image is for illustrative purposes only. Please refer to product description.

### Highlights

- High efficiency
- Selectable input voltage range
- Extremely small form factor
- Low EMI
- 4 variants available

### Features

- Advanced over current protection
- Remote controlled operation
- Low weight: 850gr.
- Compact design: 165 x 105 x 52mm

### Applications

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

### Introduction

The SMPS1200 is a high efficiency Safety Class 2 switch mode power supply specifically designed for use with our range of UcD/NCore 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 SMPS1200 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 SMPS1200 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 SMPS1200 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.



Attention: Observe precautions for handling electrostatic sensitive devices. This module uses semiconductors that can be damaged by electrostatic discharge (ESD).

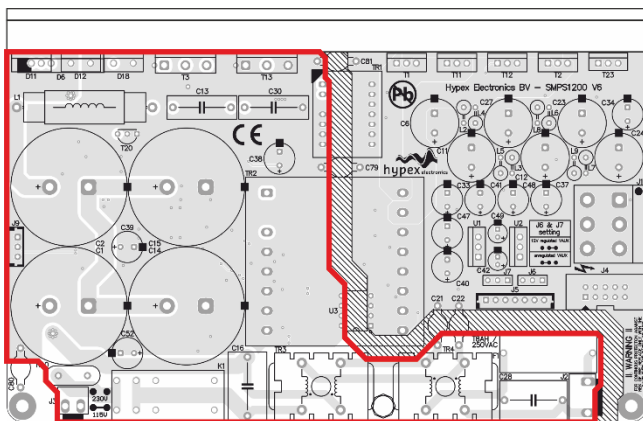
Damage due to inappropriate handling is not covered by warranty.

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



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!

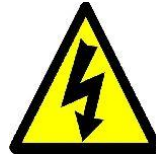
Warning: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.



This is a Safety Class 2 device. When mounting the module in an enclosure, a minimum safety distance of 6mm from the SMPS to all possible conducting parts must be ensured to keep compliance with Safety Class 2. All parts enclosed by the red line carry hazardous voltages. This includes parts on the top and the bottom of the board.

Standard the SMPS1200 is supplied as a module mounted on an L-Shaped aluminium frame. 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 6mm from the SMPS1200's footprint must be installed below the SMPS if shorter spacers are used to mount the SMPS to keep compliance with safety class 2.

## 1 Précautions de sécurité



Ce module est sous tension secteur et certaines de ses pièces accessibles sont sous une tension dangereuse. Ces pièces doivent dans tous les cas être protégées contre contacts accidentels. Lors de l'installation, une prudence extrême s'impose. Ne jamais toucher les pièces du module quand celui-ci est relié au secteur. Isoler l'appareil du secteur et attendre 10 minutes pour laisser à tous les condensateurs le temps de se décharger avant de le manipuler.



**Attention : Respecter les consignes de sécurité pour la manipulation d'appareils sensibles aux courants électrostatiques. Ce module est pourvu de semi-conducteurs qui peuvent être endommagés par les décharges électrostatiques (DES).**

Les dommages causés par un usage non approprié sont exclus de la garantie.

**Ce produit ne contient aucune pièce devant être entretenue par l'utilisateur.**



Ce symbole indique la présence de tensions dangereuses aux broches de raccordement accessibles sur la carte. Les pièces non marquées en rouge peuvent être elles aussi sous une tension supérieure à 200 VCC.

Avertissement: Pour réduire les risques de choc électrique, ne pas exposer cet appareil à la pluie ou l'humidité.

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 SMPS1200 Series

The SMPS1200 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)
SMPS1200A100	2x 40Vdc	UcD102
SMPS1200A180	2x 46Vdc	UcD180 Series,
SMPS1200A400	2x 63Vdc	UcD250LP, UcD400 Series, NC400 DIY. NC500 OEM
SMPS1200A700	2x 85Vdc	UcD700 Series, NC500 OEM, NC1200

Please refer to the amplifier's datasheet for more information.

### 3 Electrical Specifications

#### 3.1 Power Specifications

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
High Line Input Voltage	-	V <sub>B</sub>	200-240V <sub>ac</sub> ±10%			V <sub>ac</sub>	1)
Low Line Input Voltage	With Low Line jumper placed	V <sub>B,FP</sub>	100-120V <sub>ac</sub> ±10%			V <sub>ac</sub>	1)
Line Input Frequency	-	f	47		63	Hz	1)
Fuse rating	250V <sub>ac</sub> , slow blow			12		A	2)

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

Note 2: Fuse is soldered on the PCB and is therefore not user replaceable.

#### 3.2 General Performance Data

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Output Voltage Main	A100, symmetric	V <sub>OUT</sub>	2x31	2x40	2x46	V <sub>dc</sub>	1), 2)
	A180, symmetric	V <sub>OUT</sub>	2x36	2x46	2x53	V <sub>dc</sub>	1), 2)
	A400, symmetric	V <sub>OUT</sub>	2x49	2x63	2x72	V <sub>dc</sub>	1), 2)
	A700, symmetric	V <sub>OUT</sub>	2x66	2x85	2x98	V <sub>dc</sub>	1), 2)
Output Voltage V <sub>AUX</sub>	A100, symmetric	V <sub>AUX</sub>	2x15	2x20	2x22	V <sub>dc</sub>	1)
	A180, A400, symmetric	V <sub>AUX</sub>	2x17	2x22	2x25	V <sub>dc</sub>	1)
	A700, symmetric	V <sub>AUX</sub>	2x16	2x21	2x24	V <sub>dc</sub>	1)
Output Current V <sub>AUX</sub>	All versions, per rail	I <sub>AUX</sub>	-	-	500	mA	
Output Voltage V <sub>DR</sub>	A100, A180, A700	V <sub>OUT,Vdr</sub>	-	15	-	V <sub>dc</sub>	
	A400	V <sub>OUT,Vdr</sub>	-	15.6	-	V <sub>dc</sub>	
Output Current V <sub>DR</sub>	All versions	I <sub>OUT,Vdr</sub>	-	-	500	mA	
Output Voltage Regulated	All versions	V <sub>AUX,REG</sub>		2x12		V <sub>dc</sub>	
Output Current Regulated	All versions, per rail	I <sub>AUX,REG</sub>	-	60	100	mA	
In-rush current	10Ω In-rush NTC, worst-case	I <sub>inrush</sub>			37	A	
Efficiency	Full power	η	92			%	
Idle Losses	230 V <sub>ac</sub> , 50 Hz	P <sub>0</sub>	-	9	-	W	
Power consumption	Depending on load	P <sub>max</sub>			1350	W	
Switching frequency		F <sub>SW</sub>	-	100	-	kHz	

Note 1: Output voltage is proportional to the mains line voltage (Min@180V<sub>ac</sub>, Typical@230V<sub>ac</sub>, Max@264V<sub>ac</sub>).

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

#### 3.3 Timing Specifications

These timings are measured at room temperatures, approximately 21°C, 230V<sub>ac</sub>.

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	

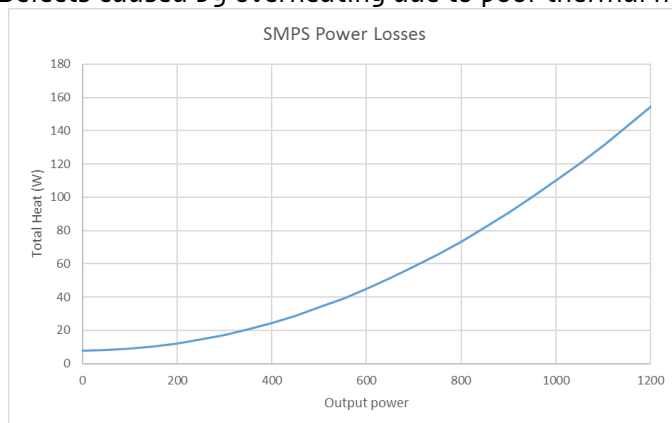
## 4 Environmental Specifications

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Ambient Temperature	Storage		-25	-	70	°C	
	Operation		0	-	50	°C	
Heat-sink Temperature		$T_{h,max}$			95	°C	1)
Humidity	Max 85 percent relative humidity, non-condensing.						

Note 1: This module features a thermal shutdown mechanism to protect against over temperature. This mechanism is meant to be a final protection. Please apply adequate cooling measures to prevent over temperature.

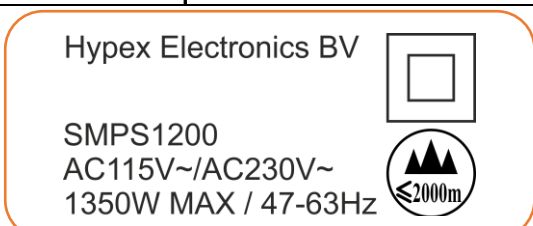

### 4.1 Heat dissipation

Switch mode power supplies' known high efficiency often leads to a gross underestimation of the cooling required. Please apply adequate cooling to the module to ensure the module operates within specification. The following graphs provide an indication of the heat (in Watts) generated at different output levels. For more information regarding cooling, please refer to our application note "Thermal Design", available on our website. Defects caused by overheating due to poor thermal management are not covered by warranty.



## 5 Product Markings

This module has two marking stickers applied.

Model sticker example	Identification sticker example
 <p>Hypex Electronics BV</p> <p>SMPS1200          AC115V~/AC230V~          1350W MAX / 47-63Hz</p>	 <p>www</p> <p>8020-0502A12345-0123          PCBA SMPS1200A100</p>

## 6 IO Specifications

### 6.1 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 SMPS1200. Putting the SMPS in standby also automatically releases the Amp Enable line, guarantying pop-free shut down of the connected UcD/NCore Amplifier. This is an opto-coupler input with a 220 ohm series resistor.

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
SMPS in standby	Logic High level		3,3	-	12	Vdc	1)
SMPS enabled	Logic Low level		-	-	0,8	Vdc	

Note 1: The current this pin draws limited to approximately 10mA

### 6.2 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	Symbol	Min	Typ	Max	Unit	Note
Amplifier in standby	Logic High level		3,3	-	V <sub>AUX</sub>	Vdc	1)
Amplifier enabled	Logic Low level		-	-	0,8	Vdc	

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

### 6.3 DC-Error

In the event of a critical failure occurring in the connected amplifier, the SMPS1200 needs to be switched off rapidly. The SMPS1200 provides a single DC Error Input designated for 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.

Note: this input is incompatible with UcD180HG and UcD400HG modules.

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
No error condition	Use open collector		-	-	-	Vdc	1)
DC Error	Pull pin to Gnd		-	Gnd	-	Vdc	1), 2)

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

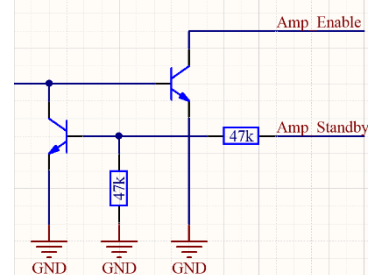
Note 2: The current (A) can be calculated as follows:  $(V_{aux} - 1.2) / 1000$

### 6.4 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 SMPS1200 is switched on and off. By doing so, it prevents unwanted audio artefacts during power cycles.

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
Collector voltage	Open collector output		-	-	50	V	
Collector current	Open collector output		-	-	100	mA	

Using Amp Standby in combination with Amp Enable one can make a pop-free control of the SMPS and amplifier setup. This circuit illustrates a part of the internal circuit of the SMPS.



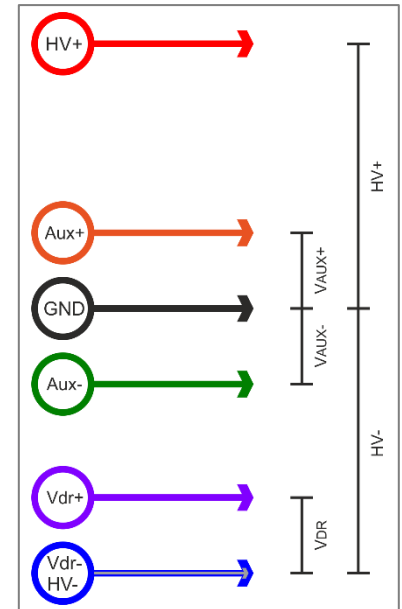


## 6.5 Bootstrap Driver Voltage ( $V_{DR}$ )

The SMPS1200 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.

*Note:*

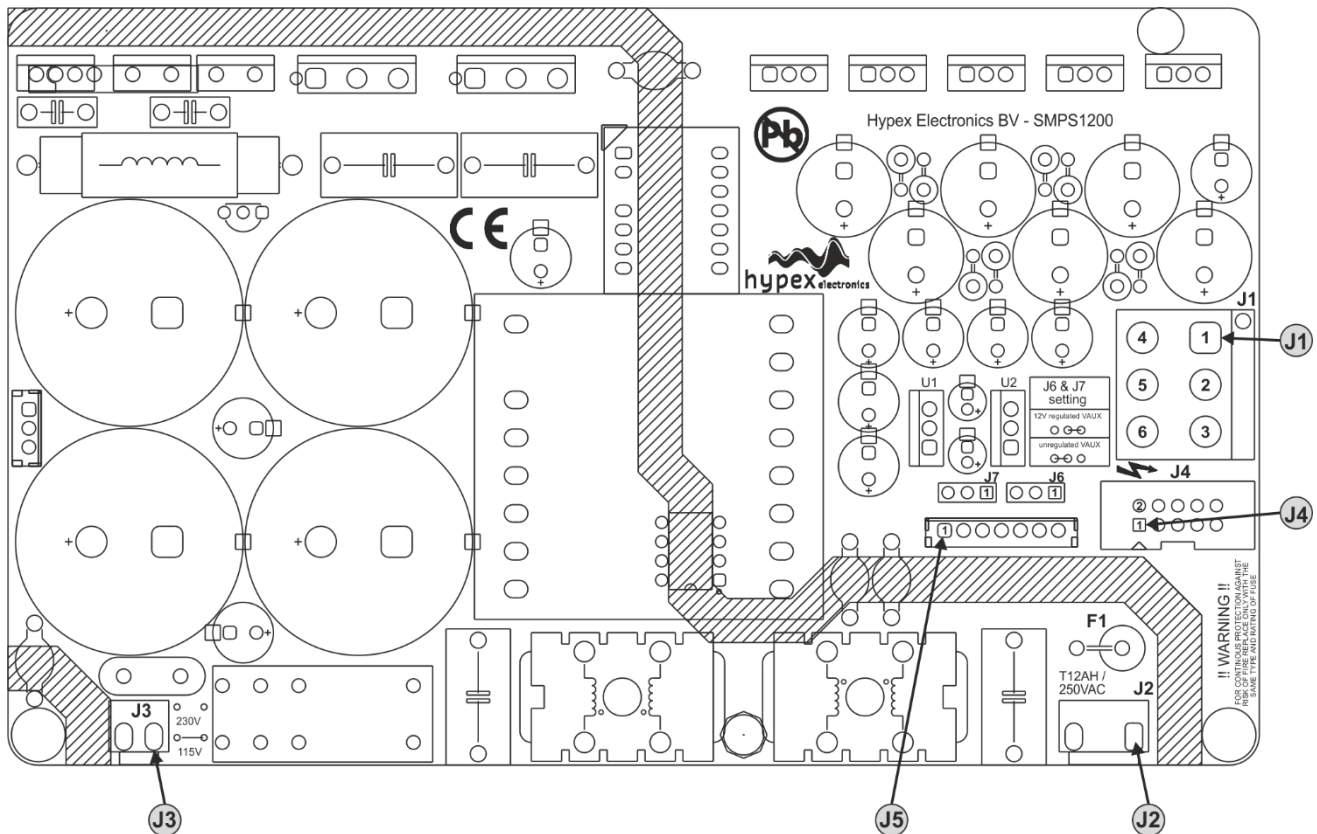
The UcD180OEM/UcD180LP OEM are available in two versions, IRF or ST. For the IRF version the SMPS1200A180  $V_{DR}$  can be used directly as an external  $V_{DR}$  supply source. The ST version requires the  $V_{DR}$  voltage to be 12V, and therefore this  $V_{DR}$  output has to be regulated down to 12V by the customer.





## 7 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.



### 7.1 Main output connector

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.

### 7.2 AC Connector Specification

Pin	Direction	Function	Remarks
J2.1	Input	Mains input	Neutral AC
J2.3	Input	Mains input	Phase AC

Connector type: B2P3-VH(LF)(SN).

Matching cable part: VHR-3N.

### 7.3 Mains Voltage Selection

Pin	Direction	Function	Remarks
J3.1-2	Jumper	Input Voltage Select	Open = 230Vac; Closed = 115Vac.

Connector type: B2P-VH.

Matching cable part: VHR-2N.

### 7.4 UcD/NCore Interface

Pin	Direction	Function	Remarks
J4.1	Output	Positive Output	Selectable Output ( $V_{AUX}$ or $V_{AUX,REG}$ ) <sup>1), 2)</sup>
J4.2	Output	Negative Output	Selectable Output ( $V_{AUX}$ or $V_{AUX,REG}$ ) <sup>1), 2)</sup>
J4.3	-	GND	Ground
J4.4	-	NC	Do not connect
J4.5	-	NC	Do not connect
J4.6	Output	Amp Enable	Amplifier enable
J4.7	-	NC	Do not connect
J4.8	-	NC	Do not connect
J4.9	-	GND	Ground
J4.10	Input	DC Error	

Connector type equivalent: T821110A1S100CEU

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

Note 1: Regulated Auxiliary Output Voltages should only be used to power the buffer stages of the connected UcD/NCore amplifiers.

Note 2: See chapter 7.6 for more information

### 7.5 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.

### 7.6 Jumper Setting ( $V_{AUX}$ or $V_{AUX,REG}$ )

J6 and J7 are used to select the output voltage on pin J4.1 and J4.2.

- Position 1-2: Regulated  $V_{AUX,REG}$
- Position 2-3: Unregulated  $V_{AUX}$

When the connected amplifier is fitted with HxR voltage regulators, both jumpers need to be set to unregulated Auxiliary voltages.  $V_{AUX,REG}$  is the default jumper setting (J6, J7).

## 8 Typical Performance Data

The SMPS1200 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 SMPS1200 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. Tested unit: SMPS1200A700, T<sub>a</sub> = 25°C. Connected amplifier: 2 x UcD700OEM, f = 1kHz.

SMPS1200 is horizontally mounted in free air without additional external cooling.

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Note
<b>Amplifier output power for 10 sec. until T<sub>sink</sub> = 95°C</b>	Load = 4Ω 230Vac/50Hz	P <sub>o</sub>	-	1200		W	
<b>Continuous output power. T<sub>sink</sub> stabilized at 95°C</b>	Load = 4Ω 230Vac/50Hz	P <sub>o</sub>	-	325		W	

### 8.1 Output Power (SMPS1200A100)

Connected amplifier: 5 x UcD102 OEM, f = 1kHz, power sweep 0W up to P<sub>max</sub>. V<sub>dr</sub> from SMPS. Number of modules is limited by V<sub>dr</sub> current. Distortion figures (THD+N) at the stated power ratings are at 1%. Figures per amplifier.

Parameter	Conditions	Symbol		Unit	Note
<b>Total amplifier output power at different input voltages.</b>	240VAC Load = 4Ω Load = 8Ω	P <sub>o</sub>	10x 110 10 x 75	W	
	230VAC Load = 4Ω Load = 8Ω	P <sub>o</sub>	10x 100 10 x 70	W	
	120VAC Load = 4Ω Load = 8Ω	P <sub>o</sub>	10x 100 10 x 70	W	
	100VAC Load = 4Ω Load = 8Ω	P <sub>o</sub>	10x 75 10 x 50	W	
	90VAC Load = 4Ω Load = 8Ω	P <sub>o</sub>	10x 60 10 x 40	W	

Note: Thermal behaviour and limitations not considered in these measurements.

Connected amplifier: 6 x UcD102 OEM,  $f = 1\text{kHz}$ , power sweep 0W up to  $P_{max}$ . Vdr generated in the UcD102. This results in a higher dissipation. Distortion figures (THD+N) at the stated power ratings are at 1%. Figures per amplifier.

Parameter	Conditions	Symbol		Unit	Note
Total amplifier output power at different input voltages.	240VAC Load = 4Ω Load = 8Ω	$P_o$	12 x 100 12 x 70	W	
	230VAC Load = 4Ω Load = 8Ω	$P_o$	12 x 95 12 x 65	W	
	120VAC Load = 4Ω Load = 8Ω	$P_o$	12 x 90 12 x 65	W	
	100VAC Load = 4Ω Load = 8Ω	$P_o$	12 x 65 12 x 48	W	
	90VAC Load = 4Ω Load = 8Ω	$P_o$	12 x 55 12 x 40	W	

Note: Thermal behaviour and limitations not considered in these measurements.

## 8.2 Output Power (SMPS1200A180)

Connected amplifier: 6 x Uc180LP OEM,  $f = 1\text{kHz}$ , power sweep 0W up to  $P_{max}$ . Distortion figures (THD+N) at the stated power ratings are at 1%.

Parameter	Conditions	Symbol		Unit	Note
Total amplifier output power at different input voltages.	240VAC Load = 4Ω Load = 8Ω	$P_o$	6x 160 6x 100	W	
	230VAC Load = 4Ω Load = 8Ω	$P_o$	6x 150 6x 95	W	
	120VAC Load = 4Ω Load = 8Ω	$P_o$	6x 150 6x 95	W	
	100VAC Load = 4Ω Load = 8Ω	$P_o$	6x 110 6x 65	W	
	90VAC Load = 4Ω Load = 8Ω	$P_o$	6x 95 6x 55	W	

Note: Thermal behaviour and limitations not considered in these measurements.

### 8.3 Output Power (SMPS1200A400)

Connected amplifier: 3 x Ucd4000EM,  $f = 1\text{kHz}$ , power sweep 0W up to  $P_{max}$ . Distortion figures (THD+N) at the stated power ratings are at 1%.

Parameter	Conditions	Symbol		Unit	Note
Total amplifier output power at different input voltages.	240VAC Load = 4Ω Load = 8Ω	$P_o$	3x 360 3x 210	W	
	230VAC Load = 4Ω Load = 8Ω	$P_o$	3x 340 3x200	W	
	120VAC Load = 4Ω Load = 8Ω	$P_o$	3x 350 3x 210	W	
	100VAC Load = 4Ω Load = 8Ω	$P_o$	3x 270 3x 140	W	
	90VAC Load = 4Ω Load = 8Ω	$P_o$	3x 200 3x 110	W	

Note: Thermal behaviour and limitations not considered in these measurements.

### 8.4 Output Power (SMPS1200A700)

Connected amplifier: 2 x Ucd7000EM,  $f = 1\text{kHz}$ , power sweep 0W up to  $P_{max}$ . Distortion figures (THD+N) at the stated power ratings are at 1%.

Parameter	Conditions	Symbol		Unit	Note
Total amplifier output power at different input voltages.	240VAC Load = 4Ω Load = 8Ω	$P_o$	2x 620 2x 370	W	
	230VAC Load = 4Ω Load = 8Ω	$P_o$	2x 600 2x 340	W	
	120VAC Load = 4Ω Load = 8Ω	$P_o$	2x 600 2x 360	W	
	100VAC Load = 4Ω Load = 8Ω	$P_o$	2x 430 2x 270	W	
	90VAC Load = 4Ω Load = 8Ω	$P_o$	2x370 2x 230	W	

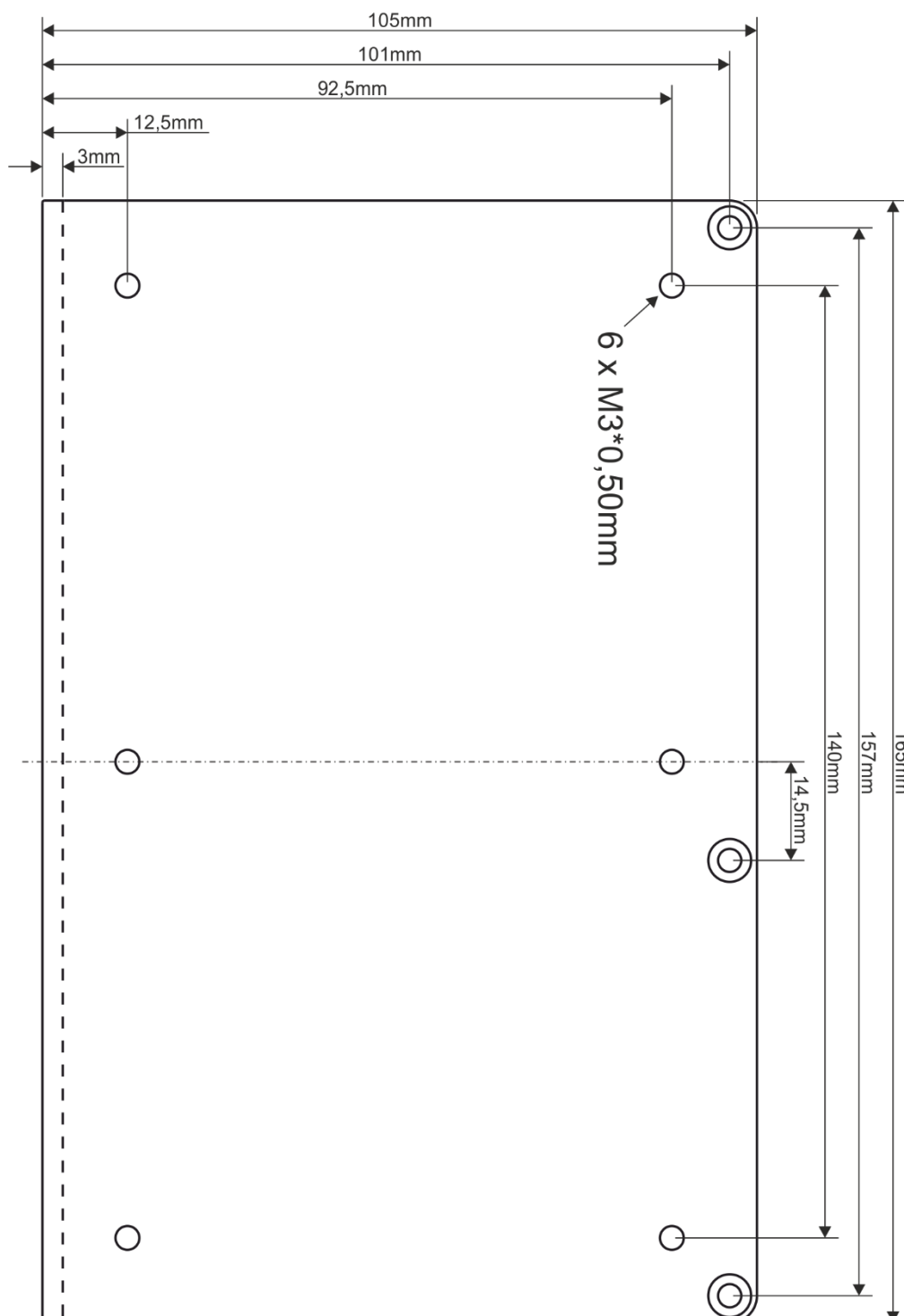
Note: Thermal behaviour and limitations not considered in these measurements.

## 9 Dimensions and Drill pattern

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

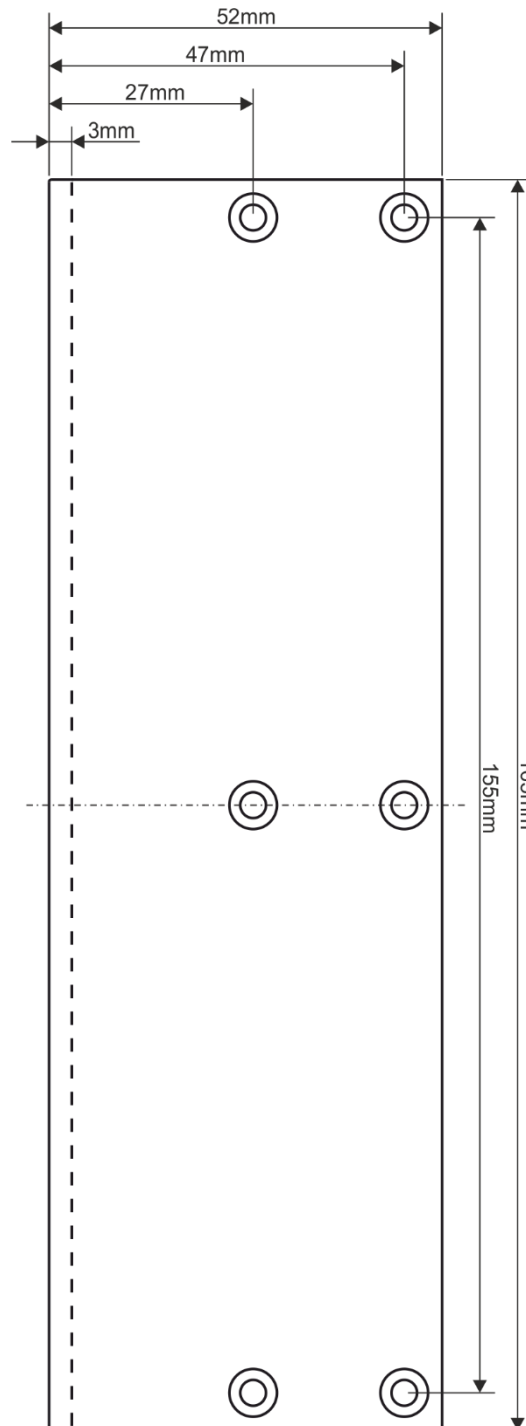
### 9.1 Bottom view, L-profile

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!



## 9.2 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!





## 10 Revisions

Document revision	Module revision	Change log	Date
07	SMPS1200 06xx	- Major PCB Update, entire mechanical setup revised - Format changed	14.01.2013
08	SMPS1200 07xx	- SMPS1200A180 added. - Power figures added/corrected	08.11.2013
09	SMPS1200 07xx		
10	SMPS1200 07xx	- Auxiliary and Vdr figures corrected	02.02.2015
11	SMPS1200 07xx	- New datasheet format - SMPS1200A100 General performance data added	16.11.2015
12	SMPS1200 07xx	- SMPS Standby feature clarified	01.05.2016
13	SMPS1200 09xx	Certification according to EN62368 Current-source circuit on the standby-pin Performance figures adjusted	

## 11 Disclaimer

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