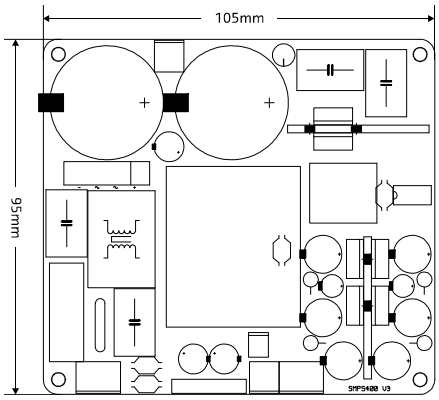
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SMPS400A180
SMPS400A400

High Efficiency Audio SMPS





Highlights

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

Features

- Advanced over current protection
- Remote controlled operation
- Low weight: 300gr.
- Compact: 105 x 100 x 42(37)mm
- Fits in 1HE (with an extra shielding)
- Fixed output voltage (2 versions available)

Applications

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

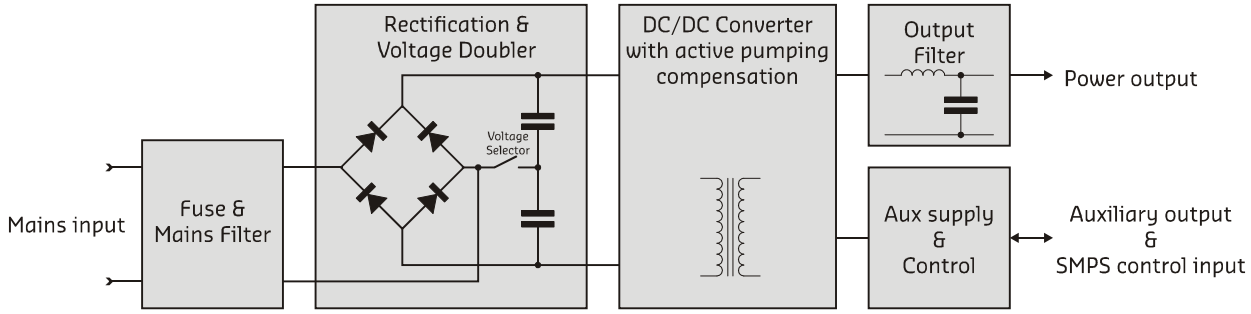
Description

The SMPS400 is a high efficiency Safety Class 2 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 SMPS400 also features an advanced over current protection which in case of temporary overload simply reduces the output voltage, 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 electrolytic buffer capacitors leads to the capability of delivering high dynamic headroom power to the connected amplifier. The SMPS400 also includes an auxiliary isolated 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 a critical fault via in built-in actuators. The SMPS400 is optimized from the first phase of design to final implementation to realize the low EMI signature required of the most demanding audio applications.

Contents

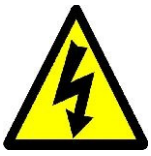
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1 Principle of operation



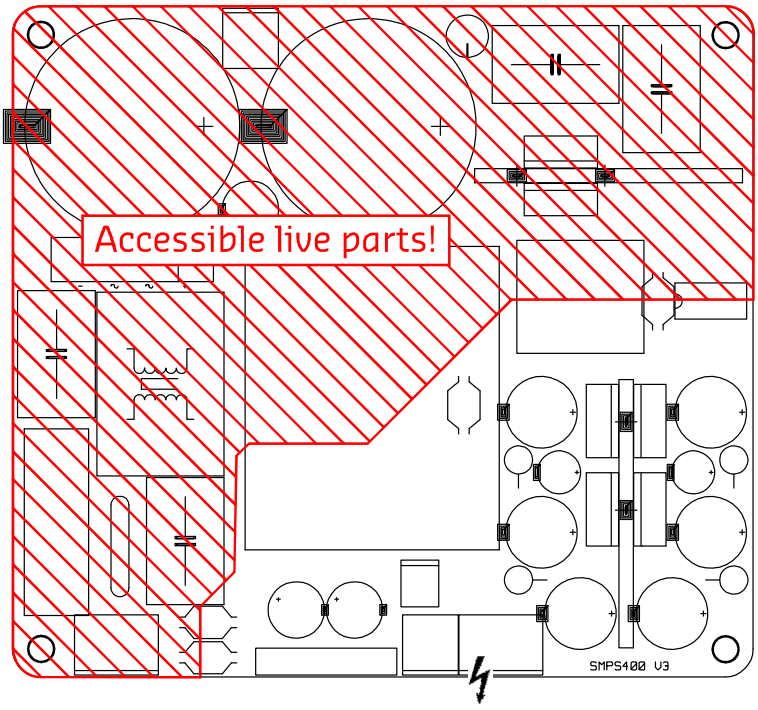
Conventional Switch Mode Power Supplies are commonly unsuitable for audio purposes due to poor peak power capabilities and the inability to handle reversed currents generated by Class D amplifiers as a load. The Hypex SMPS400 achieves these things by using an advanced over current protection circuit, a highly efficient 2 quadrant DC/DC converter which is capable of handling reversed currents and has a peak power handling of many times its rated power.

2 Safety precautions



The SMPS400 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 serviceable parts other than the on-board fuse. Replace the fuse only with the same type and rating (250V T5AL).



This is a Safety Class 2 device. It is very important to maintain a 6mm clearance with all possible conducting parts (housing etc.) and cables. All parts enclosed by the dotted line below carry hazardous voltages. This includes parts on the top and the bottom of the board. When the SMPS400 is mounted in a tight space there needs to be at least 6mm clearance or a layer of insulation with a minimum thickness of 0.5mm between the top of the transformer and the housing. Only use insulated spacers in the dotted area. The fourth hole should a conductive spacer to improve EMI preformance.

10mm Spacers are available on the Hypex webshop to mount the SMPS onto the chassis. This creates the mandatory 6mm 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, for instance a 1HE 19" enclosure, one shall need to use smaller spacers and provide a layer of insulation both above and below the SMPS with a minimum thickness of 0.5mm in order to comply with the Class 2 Safety Directive. If these measures are taken into account, the maximum overall height can be reduced to 37mm.

3 Instructions For Installation

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 10 minutes before handling it.



This symbol indicates the presence of hazardous voltages at accessible conductive terminals on the board. Parts that are not highlighted in red (picture above) may carry voltages in excess of 140VDC!

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. This product is to be used with Hypex amplifier modules only.
11. Only the ready-made cable sets provided by Hypex may be used for external wiring of the SMPS400.
12. Don't run any cables across the top or the bottom of the SMPS400. Apply fixtures to cables to ensure that this is not compromised.
13. Observe a minimum distance of 6mm maintain clearance with all possible conducting parts (housing etc.). All parts enclosed by the dotted line below carry hazardous voltages. This includes parts on the top and the bottom of the board. When the SMPS400 is mounted in a tight space there needs to be at least 6mm clearance or a layer of insulation with a minimum thickness of 0.5mm between the top of the transformer and the housing.
14. Natural convection should not be impeded by covering the SMPS400 (apart from the end applications housing).

4 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_{AMB}	50	ºC	
Heat-sink temperature	T_{SINK}	95 [1)]	ºC	

Note 1: Unit will shut down when T_{SINK} exceeds 95º due to thermal protection

5 Recommended Operating Conditions

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

6 General Performance data (All versions)

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Current Aux	$I_{OUT,AUX}$	500m	-	-	A	per rail
Max Output Power	P_R	600	-	-	W	1)
Max Audio Output Power @ 20Hz into amplifier load	P_{RALF}	400	-	-	W	2)
Efficiency	η		TBD		%	full power
Idle Losses	P_0		5		W	
Standby Power	$P_{standby}$		TBD		W	
Switching frequency	F_{SW}	80	100	120	kHz	
Maximum power consumption	P_{max}			800	W	3)

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: Limited by over current protection.

7 General Performance data (SMPS400A400)

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Voltage	V_{OUT}	2 x 48	2 x 63	2 x 72	Vdc	1)
Max Output Short Circuit Current (Rail to rail)	$I_{OUT,MAX}$	-	7	-	Adc	2)
Unregulated Output Voltage Aux	$V_{OUT,AUX}$	2 x 16	2 x 21	2 x 24	Vdc	1)

Note 1: Output voltage is proportional to the mains line voltage (Min@180Vac, Typical@230Vac, Max@264Vac).
Note 2: Limited by over current protection.

8 General Performance data (SMPS400A180)

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Voltage	V_{OUT}	2 x 36	2 x 46	2 x 52	Vdc	1)
Max Output Short Circuit Current (Rail to rail)	$I_{OUT,MAX}$	-	10	-	Adc	2)
Unregulated Output Voltage Aux	$V_{OUT,AUX}$	2 x 18	2 x 23	2 x26	Vdc	1)

Note 1: Output voltage is proportional to the mains line voltage (Min@180Vac, Typical@230Vac, Max@264Vac).
Note 2: Limited by over current protection.

9 Output Power Performance data (SMPS400A400)

The SMPS400 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 1/8th of the maximum peak power. The SMPS400 is therefore perfectly capable of driving the connected amplifier in clipping continuously with a music signal without the need of additional external cooling.

Unless otherwise specified. T_a = 25ºC. Connected amplifier: UcD400OEM, f = 1kHz.
SMPS400 is horizontally mounted in free air without additional external cooling. Amplifier is driven till thermal protection comes in. Measurements are done without preheating. Distortion figures (THD+N) at the stated power ratings are below 1%.

Item	Symbol	Conditions	Typ	Unit	Notes
Amplifier output power for 90sec.	P_o	BTL Load = 8Ω 120Vac/60Hz 230Vac/50Hz	 500 550	 W	2 x UcD400OEM In BTL configuration
Amplifier output power for 5 min.	P_o	BTL Load = 8Ω 120Vac/60Hz 230Vac/50Hz	 330 350	 W	2 x UcD400OEM® In BTL configuration
Continuous output power.	P_o	Load = 4Ω 120Vac/60Hz 230Vac/50Hz	 230 240	 W	

10 Output Power (SMPS400A400)

Connected amplifier: UcD400OEM, f = 1kHz. Distortion figures (THD+N) at the stated power ratings are at 1%.

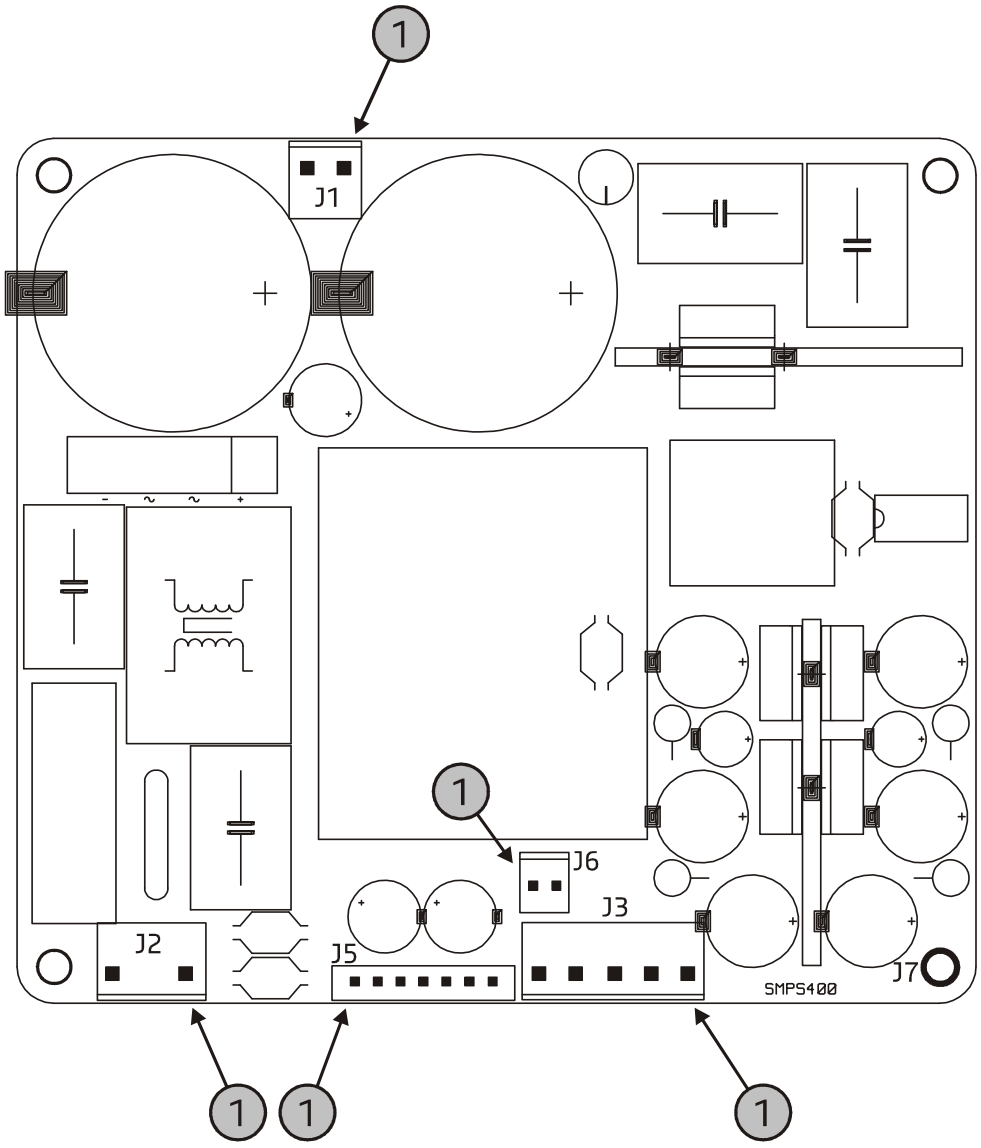
Item	Symbol	Conditions	Typ	Unit	Notes
Amplifier output power at different input voltages.	P_o	240VAC Load = 4Ω Load = 8Ω	 410 235	W	
	P_o	230VAC Load = 4Ω Load = 8Ω	 375 215	W	
	P_o	120VAC Load = 4Ω Load = 8Ω	 345 220	W	
	P_o	90VAC Load = 4Ω Load = 8Ω	 205 125	W	

11 Output Power (SMPS400A180)

Connected amplifier: UcD180OEM, f = 1kHz. Distortion figures (THD+N) at the stated power ratings are at 1%.

Item	Symbol	Conditions	Typ	Unit	Notes
Amplifier output power at different input voltages.	P_o	240VAC Load = 4Ω Load = 8Ω	 190 120	W	
	P_o	230VAC Load = 4Ω Load = 8Ω	 185 115	W	
	P_o	120VAC Load = 4Ω Load = 8Ω	 140 105	W	
	P_o	90VAC Load = 4Ω Load = 8Ω	 90 65	W	

12 Connector Pinout



12.1 J1: Mains Voltage Input Selection

Connector type: JST-B2P-VH

Pin	Function
1,2	Not Connected = 230Vac Mains; Connected = 115Vac Mains

12.2 J2: Mains Input

Connector type: JST-B3P-VH

Pin	Function
1,3	Mains Input
2	NC

Note : As per Class 2 ground is NC and so unavailable for safety ground. You must follow Class 2 safety standards in implementing the SMPS400. Also read http://www.hypex.nl/docs/earth.pdf

12.3 J3: Main Output Connections

Connector type: JST-B5P-VH

Pin	Type	Function
1	Output	Positive Output Voltage (Vcc)
2	Output	Output Ground
3	Output	Negative Output Voltage (Vee)
4	Input	DC Error Input (OEM amplifier series only)
5	Output	Auto Amplifier Enable

12.4 J5: Aux & Control

Connector type: JST-B7B-EHA

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

12.5 J6: DC Error

Connector type: 2-pin MOLEX® KK® series 22-27-2021

Pin	Type	Function
1	Input	DC Error Input 1 (UcD®-series ST/HG or generic amplifier)
2	Input	DC Error Input 2 (UcD®-series ST/HG or generic amplifier)

12.6 J7: Chassis grounding

J7 is connected to secondary ground with a 100nF capacitor. Connect J7 to chassis with a metal spacer for optimum EMI performance.

13 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 SMPS400. Putting the SMPS in standby also automatically release the Auto Amplifier Enable line guaranteeing pop-free shut down of the connected UcD® amplifier.

Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J5:1	input	3,3		12	Vdc	

14 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 J5:2	input	0		Vcc	Vdc	

15 Unregulated Auxiliary Output Characteristics SMPS400A400

The SMPS400 provides Unregulated Auxiliary Output Voltages that are available for external auxiliary purposes.

Item	Type	Min	Typ	Max	Unit	Notes
Positive DC voltage on J5:3	output	-	21 [1)]	-	Vdc	
Negative DC voltage on J5:7	output	-	-21 [1)]	-	Vdc	

Note 1: Output voltage is fixed by design and proportional to the mains line voltage (Typical @230Vac).

16 Unregulated Auxiliary Output Characteristics SMPS400A180

The SMPS400 provides Unregulated Auxiliary Output Voltages that are available for external auxiliary purposes.

Item	Type	Min	Typ	Max	Unit	Notes
Positive DC voltage on J5:3	output	-	23 [1)]	-	Vdc	
Negative DC voltage on J5:7	output	-	-23 [1)]	-	Vdc	

Note 1: Output voltage is fixed by design and proportional to the mains line voltage (Typical @230Vac).

17 Output Voltage Characteristics SMPS400A400

Item	Type	Min	Typ	Max	Unit	Notes
Positive DC voltage on J3:1	Output	-	63 [1) 2)]	-	Vdc	
Negative DC voltage on J3:3	Output	-	-63 [1) 2)]	-	Vdc	

Note 1: Output voltage is fixed by design and proportional to the mains line voltage (Typical @230Vac).
Note 2: These outputs are fully long term shortcut protected: outputs to ground, output to output.

18 Output Voltage Characteristics SMPS400A180

Item	Type	Min	Typ	Max	Unit	Notes
Positive DC voltage on J3:1	Output	-	46	-	Vdc	See note 1,2
Negative DC voltage on J3:3	Output	-	-46	-	Vdc	See note 1,2

Note 1: Output voltage is fixed by design and proportional to the mains line voltage (Typical @230Vac).
Note 2: These outputs are fully long term shortcut protected: outputs to ground, output to output.

19 Output Grounds Characteristics

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

20 DC Error Input Characteristics

In the event of a critical failure occurring in the connected amplifier which may cause damage to the connected loudspeaker, the SMPS400 needs to be switched-off rapidly. The SMPS400 provides a single DC Error Input designated for a UcD® OEM series amplifier. The DC-Error Input is latched and will not auto-recover. The SMPS400 needs to be disconnected from the mains a couple of minutes to reset.

Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J3:4	Input				Vdc	1)

Note 1: Pin 33 of the 36-pin connector on the UcD180OEM/UcD400OEM or pin 8 of the 14-pin connector on the UcD180LPOEM needs to be connected to this pin to enable this function. Multiple modules can be connected to this pin.

21 Auto Amplifier Enable Characteristics

When the enable-line of a UcD®-series amplifier is connected to this pin the amplifier will be enabled and disabled automatically when the SMPS400 is switched on and off preventing unwanted audio artefacts during power-up and power-down.

Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J3:5	Output					Internal open collector

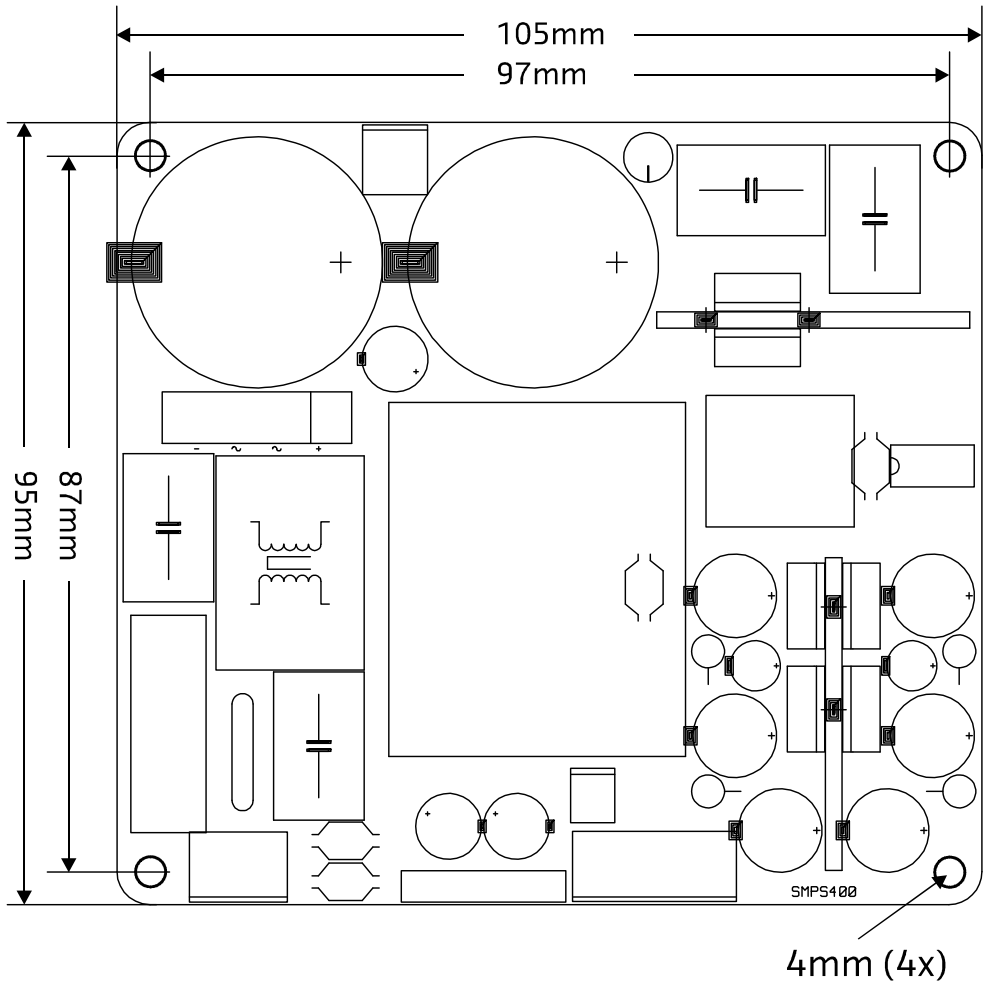
22 DC Error Input 1 & 2 Characteristics

In the event of a critical failure occurring in the connected amplifier which may cause damage to the connected loudspeaker, the SMPS400 needs to be switched-off rapidly. The SMPS400 provides double generic DC-Error Inputs. These DC-Error Inputs are latched and will not auto-recover. The SMPS400 needs to be disconnected from the mains for at least 3 seconds to reset. A total of two modules can be connected.

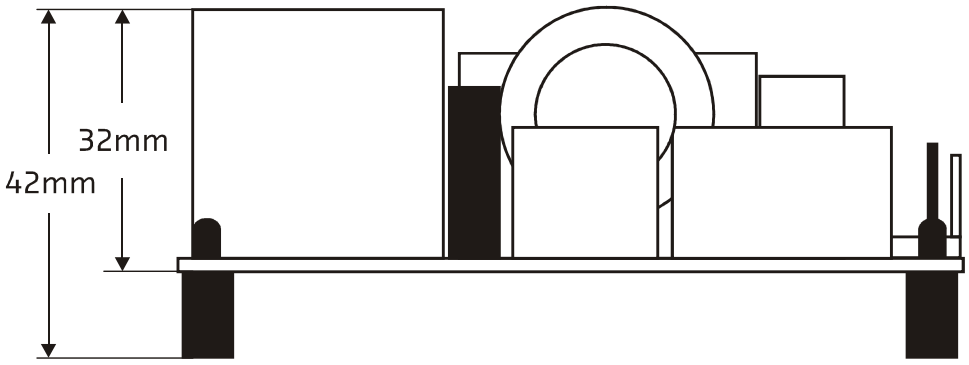
Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J6:1,2	Input					1)

Note 1: The positive loudspeaker output of a UcD®-series ST/HG or generic amplifier needs to be connected to either J6:1 or J6:2 to enable this function.

23 Dimensions. Top view.



24 Dimensions. Side view.



Note: Mounting spacers are not included in the package. Spacer sets can be ordered separately through the web shop.

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.

Document Revision	PCB Version	Description	Date
R1	SMPS400V1	Initial Draft. Applicable to SMPS400/67/47/37 V1	26.02.2009
R2	SMPS400V2	- /37 version deleted. - /47 output voltage increased from 47V to 49V.	03.04.2009
R3	SMPS400V3	- Changed output connector style for compatibility reasons. - Current limiter further improved. - Transformer changed for better efficiency. - Audiophile performance improved.	04.05.2009
R4	SMPS400V4	TR3 moved for better fit.	
R5	SMPS400V4	- Auxiliary output voltage increased to 2 x 21V. - J3/J4 combined to a single 5-pin header to avoid wiring errors.	05.06.2009
R6	SMPS400V5	- Product names changed to indicate which amplifier should be used with the SMPS400 (..A180, ..A400) . - J3/J4 combined to J5. Connection tables adjusted. - Trademark signs (UcD™ into UcD®) . - Several component changes in input and output stage.	10.02.2010
R7	SMPS400V6	- Output voltage reduced to comply to mains range.	03.03.2010
R8	SMPS400V8	- Installation instruction added.	01.06.2010
R9	SMPS400V8	- Output voltages corrected. - Output power data added.	20.07.2010
R10	SMPS400V8	- Power figures corrected. - Thermal cut-off threshold added. - Safety precautions extended.	19.11.2010
R11	SMPS400V9	- Output power figures corrected for 46V output variant. - DC-error reset procedure changed.	20.01.2011
R12	SMPS400V9	- Auxiliary output voltage corrected. - DC-error input characteristics corrected.	04.04.2011
R13	SMPS400V9	- Spacers are not included in package text added. - J7 grounding connection added	05.05.2011
R14	SMPS400V9	- Idle losses corrected - Thermal performance data	13.05.2011
R15	SMPS400V9	- Correct auxiliary output voltage ambiguity	06.06.2011
R16	SMPS400V9	- Connector references corrected in description table - Format changed	05.06.2012
R17	SMPS400V9	- Aux supply information changed	07.12.2012