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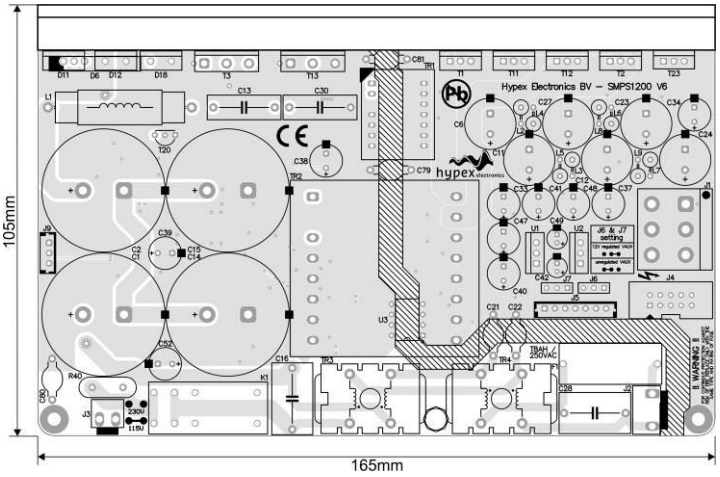
SMPS1200A180
SMPS1200A400
SMPS1200A700

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: 850gr.
- Compact: 165 x 105 x 52mm
- Fixed output voltage (3 versions available)

Applications

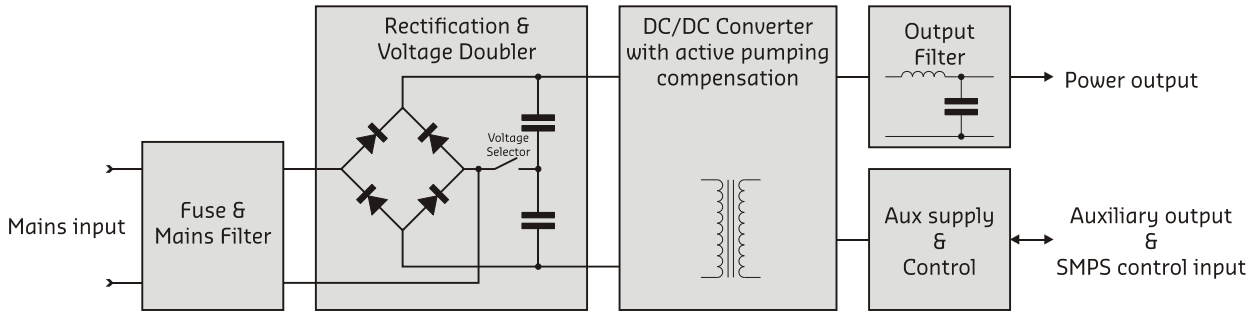
- Supply for single or multiple amplifiers of the UcD and NCore ranges
- Active loudspeakers

Description

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 an auxiliary isolated supply and a control circuit directly interfacing with our range of (OEM and standard) UcD/NCore amplifier modules. The supply is triggered for normal operation or latched off in case of critical fault via in 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.

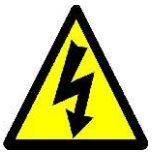
Contents

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 SMPS1200 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

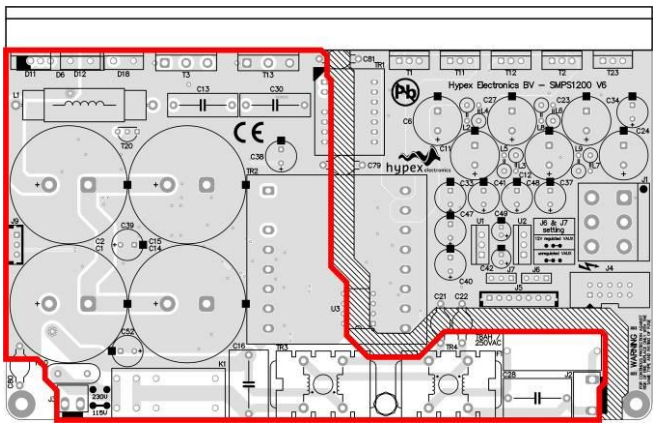


The SMPS1200 operates at mains voltage and carries hazardous voltages at accessible parts. These parts may never be exposed to inadvertent touch. Observe extreme care during installation and never touch any part of the unit while it is connected to the mains. Disconnect the unit from the mains and allow 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 (T12H).

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 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. 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 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 2 Safety Directive. If these measures are taken into account, the maximum height can be reduced to 45mm.



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 200VDC!

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 SMPS1200.
12. Don't run any cables across the top or the bottom of the SMPS1200. 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 (picture above) carry hazardous voltages. This includes parts on the top and the bottom of the board. When the SMPS1200 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 SMPS1200 (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	°C	
Heat-sink temperature	T_{SINK}	95	°C	

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
Regulated Output Voltage Aux	$V_{OUT,AUX,REG}$		2 x 12		Vdc	
Unregulated Output Current Aux	$I_{OUT,AUX}$	-	-	500m	A	per rail
Max Output Power	P_R	1500	-	-	W	1)
Max Audio Output Power @ 20Hz into amplifier load	P_{RALF}	1200	-	-	W	2)
Efficiency	η		92		%	full power
Standby Power	$P_{standby}$		0,75		W	
Idle Losses	P_0		9		W	
Switching frequency	F_{SW}		100		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.

6.1 General Performance data (SMPS1200A180)

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Voltage	V_{OUT}	2x36	2x46	2x53	Vdc	1), 2)
Unregulated Output Voltage Aux	$V_{OUT,AUX}$	2 x 17	2 x 22	2 x 25	Vdc	1)
Regulated Output Voltage Vdr	$V_{OUT,Vdr}$		15		Vdc	3)

Note 1: Output voltage is proportional to the mains line voltage (Typical 230Vac).
Note 2: These outputs are fully long term shortcut protected: outputs to ground, output to output.
Note 3: UcD180OEM/UcD180LP OEM are available in two variants, see 8.11 for further explanation.

6.2 General Performance data (SMPS1200A400)

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Voltage	V_{OUT}	2x49	2x63	2x72	Vdc	1), 2)
Unregulated Output Voltage Aux	$V_{OUT,AUX}$	2 x 17	2 x 22	2 x 25	Vdc	1)
Regulated Output Voltage Vdr	$V_{OUT,Vdr}$		15,6		Vdc	

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

6.3 General Performance data (SMPS1200A700)

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Voltage	V_{OUT}	2 x 66	2 x 85	2 x 98	Vdc	1), 2)
Unregulated Output Voltage Aux	$V_{OUT,AUX}$	2 x 16	2 x 21	2 x 24	Vdc	1)
Regulated Output Voltage Vdr	$V_{OUT,Vdr}$		15		Vdc	

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

7 Output Power 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 1/8th 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_a = 25ºC. Connected amplifier: 2 x UcD700OEM, f = 1kHz.
SMPS1200 is horizontally mounted in free air without additional external cooling.

Item	Symbol	Conditions	Min	Typ	Max	Unit	Notes
Amplifier output power for 5 min. until T_{Sink} = 95ºC	P_o	Load = 4Ω 230Vac/50Hz		1200		W	
Continuous output power. T_{Sink} stabilized at 95ºC	P_o	Load = 4Ω 230Vac/50Hz		325		W	

7.1 Output Power (SMPS1200A180)

Connected amplifier: 2 x Uc180OLP OEM, f = 1kHz. Distortion figures (THD+N) at the stated power ratings are at 1%.

Item	Symbol	Conditions			Unit	Notes
Total amplifier output power at different input voltages.	P_o	240VAC Load = 4Ω Load = 8Ω	 6x 160 6x 100	 6x 180 6x 120	W	
	P_o	230VAC Load = 4Ω Load = 8Ω	 6x 150 6x 95	 6x 170 6x 110	W	
	P_o	120VAC Load = 4Ω Load = 8Ω	 6x 150 6x 95	 6x 170 6x 110	W	
	P_o	100VAC Load = 4Ω Load = 8Ω	 6x 110 6x 65	 6x 140 6x 75	W	
	P_o	90VAC Load = 4Ω Load = 8Ω	 6x 95 6x 55	 6x 120 6x 65	W	

7.2 Output Power (SMPS1200A400)

Connected amplifier: 2 x UcD400OEM, f = 1kHz. Distortion figures (THD+N) at the stated power ratings are at 1%.

Item	Symbol	Conditions			Unit	Notes
Total amplifier output power at different input voltages.	P_o	240VAC Load = 4Ω Load = 8Ω	 3x 360 3x 210	 3x 420 3x240	W	
	P_o	230VAC Load = 4Ω Load = 8Ω	 3x 340 3x200	 3x 400 3x 230	W	
	P_o	120VAC Load = 4Ω Load = 8Ω	 3x 350 3x 210	 3x 410 3x 240	W	
	P_o	100VAC Load = 4Ω Load = 8Ω	 3x 270 3x 140	 3x 290 3x 150	W	
	P_o	90VAC Load = 4Ω Load = 8Ω	 3x 200 3x 110	 3x 220 3x 120	W	

7.3 Output Power (SMPS1200A700)

Connected amplifier: 2 x UcD700OEM, f = 1kHz. Distortion figures (THD+N) at the stated power ratings are at 1%.

Item	Symbol	Conditions			Unit	Notes
Total amplifier output power at different input voltages.	P_o	240VAC Load = 4Ω Load = 8Ω	 2x 620 2x 370	 2x 700 2x 420	W	
	P_o	230VAC Load = 4Ω Load = 8Ω	 2x 600 2x 340	 2x 660 2x 380	W	
	P_o	120VAC Load = 4Ω Load = 8Ω	 2x 600 2x 360	 2x 670 2x 410	W	
	P_o	100VAC Load = 4Ω Load = 8Ω	 2x 430 2x 270	 2x 560 2x 310	W	
	P_o	90VAC Load = 4Ω Load = 8Ω	 2x370 2x 230	 2x 470 2x 260	W	

8 Connector pinout

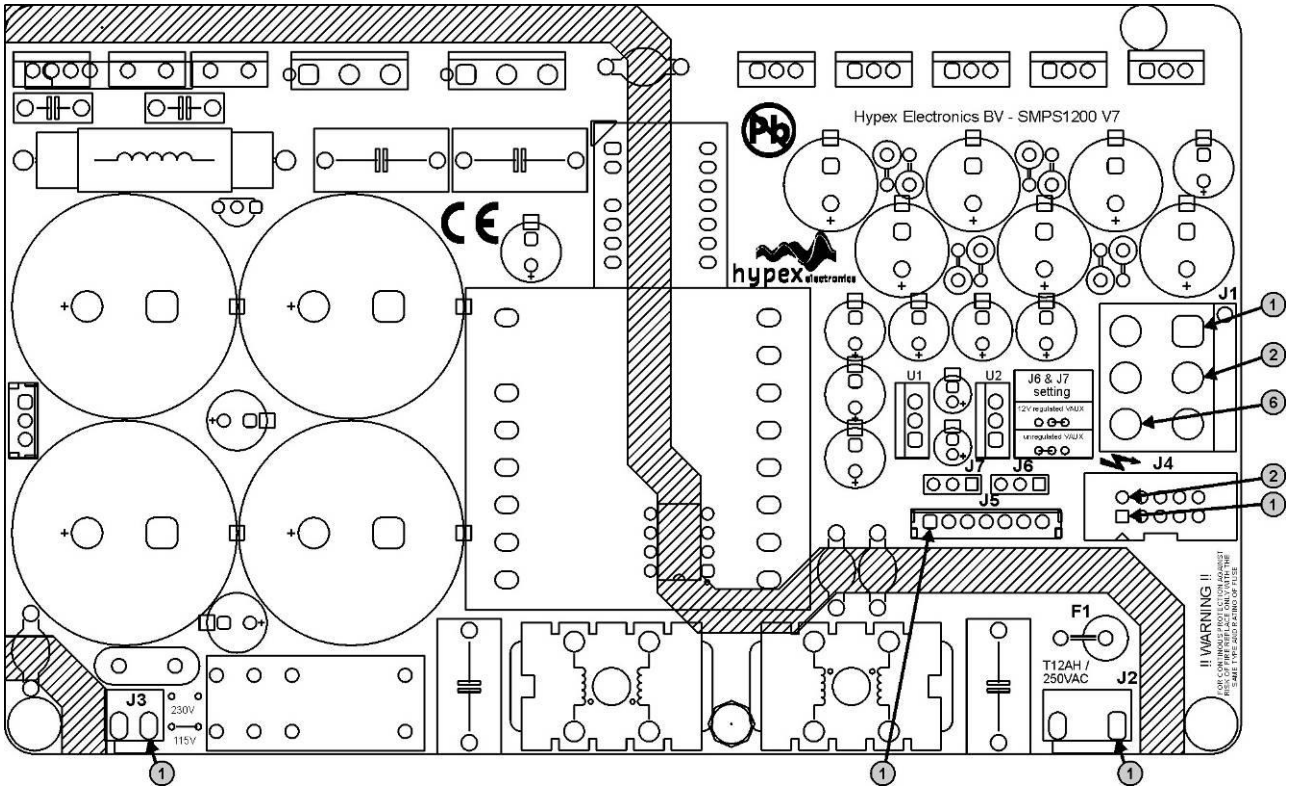


Figure 1: Connector pinning SMPS1200.

8.1 J1: Main Output Connections

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

Pin	Function
1	Positive Bootstrap Driver Voltage (VdrP) [1)]
2	Positive Output Voltage (Vcc)
3	Output Ground
4	Negative Bootstrap Driver Voltage (VdrN) [1)]
5	Negative Output Voltage (Vee)
6	Output Ground

Note 1: Driver voltage further explained in 8.11

8.2 J2: Mains Input

Connector type: JST (www.jst.com) B2P3-VH. Matching cable part: VHR-3N

Pin	Function
1,3	Mains Input
2	[1)]

Note 1: As per Class 2 ground is NC and so unavailable for safety ground. You must follow Class 2 safety standards in implementing the SMPS1200. Also read http://www.hypex.nl/docs/earth.pdf

8.3 J3: Mains Voltage Input Selection

Connector type: JST (www.jst.com) B2P-VH. Matching cable part: VHR-2N

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

8.4 J4: UcD700/NC1200 interface. Connector type: 2 x 5Pin Boxheader

Pin	Function
1	Positive Regulated Auxiliary Output Voltage (+12V) [1), 2)]
2	Negative Regulated Auxiliary Output Voltage (-12V) [1), 2)]
3	Ground
4	NC
5	NC
6	Auto Amplifier Enable
7	NC
8	NC
9	Ground
10	DC Error Input

Note 1: Regulated Auxiliary Output Voltages should only be used to power the buffer stages of connected UcD/NCore amplifiers.
Note 2: Default jumper setting (J6, J7). When the connected amplifier is fitted with HxR voltage regulators both jumpers need to be set to 2-3 position for unregulated Auxiliary voltages.

8.5 J5: Aux Voltage & PS Control

Connector type: JST (www.jst.com) B7B-EH. Matching cable part: EHR-7

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

8.6 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 SMPS1200. Putting the SMPS in standby also automatically release the Auto Amplifier Enable line guarantying pop-free shut down of the connected UcD/NCore Amplifier.

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

8.7 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	

8.8 Auxiliary Output Characteristics

The SMPS1200 provides either Regulated or Unregulated Auxiliary Output Voltages which are used to power the UcD or NCore buffer stages. Regulated or Unregulated voltages can be selected through jumpers J6/J7.

Item	Type	Min	Typ	Max	Unit	Notes
Positive Regulated DC voltage on J4:1	output		12		Vdc	1)
Negative Regulated DC voltage on J4:2	output		12		Vdc	1)

Note 1: These outputs are short term shortcut protected (2 sec.)

8.9 Driver Voltage Output Characteristics

The SMPS1200 provides a regulated +15V/+15,6V supply voltage which can be used to power the driver circuit of a UcD or NCore series amplifier. These amplifiers need the 15V/15,6V supply voltage referenced to its negative supply rail (Vee). In order to achieve this, the "Negative Bootstrap Driver Voltage" (VdrN) would have to be connected to its negative supply rail (Vee) at the amplifier side. The "Positive Bootstrap Driver Voltage" (VdrP) then can be connected to the UcD/NCore series Vdr supply input.

The UcD180OEM/UcD180LP OEM are available in two versions, IRF or ST. For the IRF version the 15V Vdr can be used directly as an external Vdr supply source. The ST version requires the Vdr voltage to be 12V, and therefore this Vdr output has to be regulated down to 12V by the customer.

8.10 Output Grounds Characteristics

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

8.11 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 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. The SMPS1200 needs to be disconnected from the mains a couple of minutes to reset.

Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J4:10	Input				Vdc	Use open collector 1)

Note 1: Modules can be connected to this pin.

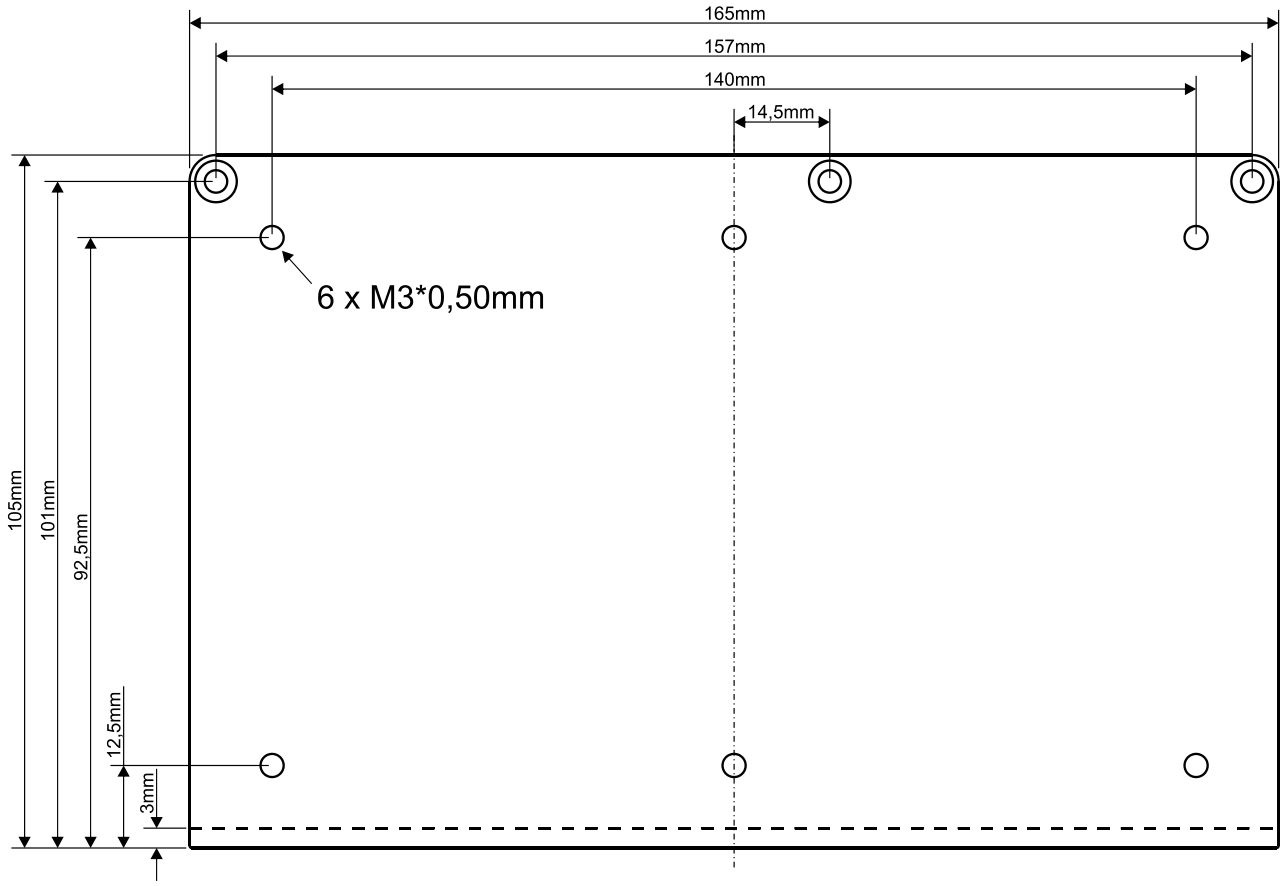
8.12 Auto Amplifier Enable Characteristics

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 preventing unwanted audio artefacts during powerup and powerdown.

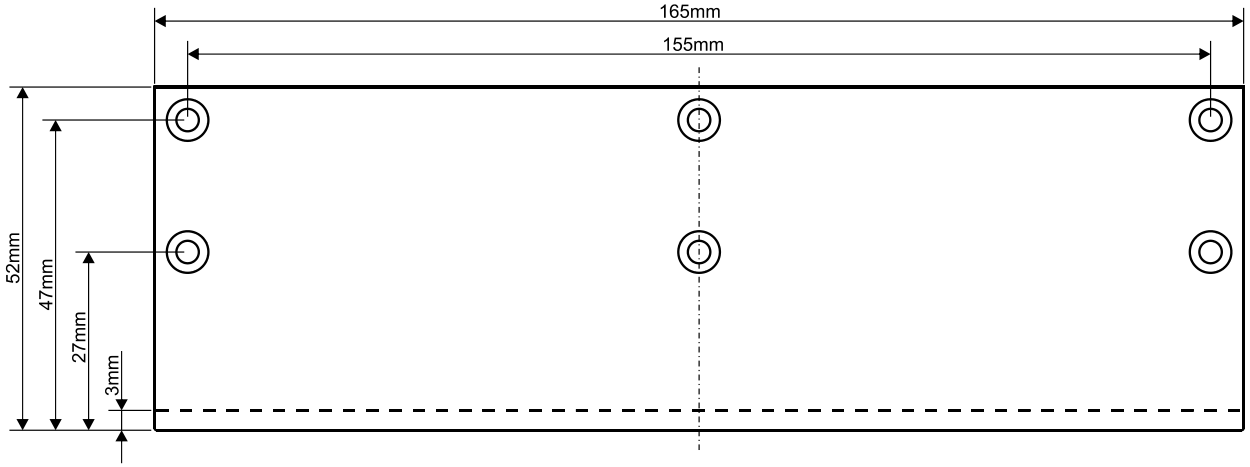
Item	Type	Min	Typ	Max	Unit	Notes
DC voltage on J4:6	Output					Internal open collector

9 Mounting Dimensions

9.1 Bottom view L-profile



9.2 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.

Document Revision	PCB Version	Description	Date
R1	SMPS1200V1	Initial Draft. Applicable to SMPS1200 V1.0	08.06.2009
R2	SMPS1200V2	- Product names changed to indicate which amplifier should be used with the SMPS1200 (..A400, ..A700) - Installation instruction added - Connector and pin out changed - Output voltage lowered - Output power data added - Product picture changed	10.08.2010
R3	SMPS1200V2	- Connector J1, J4 pin out corrected	06.11.2010
R4	SMPS1200V3	- Instructions added for use with HxR fitted amplifiers.	29.10.2010
R5	SMPS1200V3	- Instructions added for use of driver voltage - Power figures corrected. - Thermal cut-off threshold added.	19.11.2010
R6	SMPS1200V3	- Idle losses corrected	
R7	SMPS1200V6	- Major PCB Update, entire mechanical setup revised - Format changed	14.01.2013
R8	SMPS1200V7	- SMPS1200A180 added. - Power figures added/corrected	08.11.2013