

High Efficiency High Power Audio SMPS



Highlights

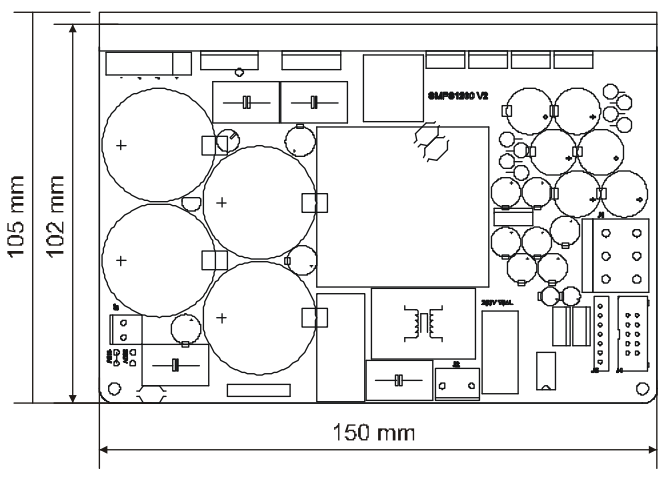
- High efficiency
- Selectable input voltage range
- Low EMI

Features

- Advanced over current protection
- Remote controlled operation
- Low weight: 750gr.
- Compact: 150 x 105 x 55mm
- Fixed output voltage (2 versions available)

Applications

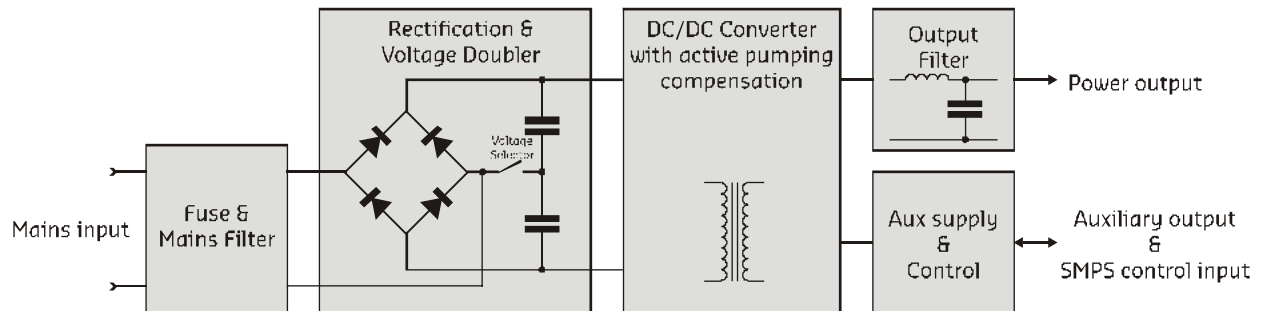
- Supply for single or multiple amplifiers of the UcD™ range
- Active loudspeakers



Description

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

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.

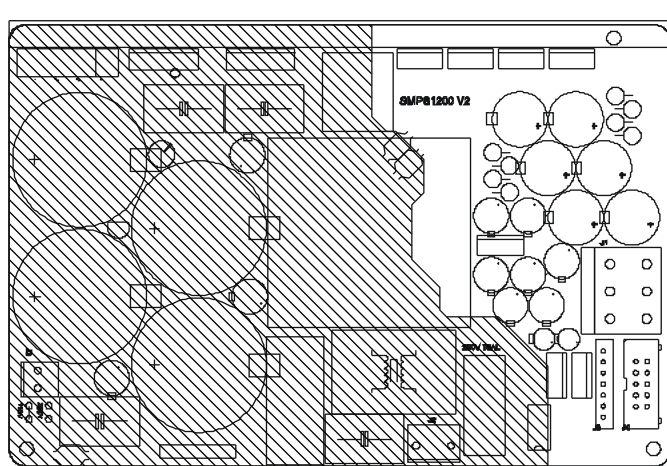
Safety precautions



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 (T5H).

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 hatched area 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 47mm.

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).

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} | 264 | Vac | |
| Air Temperature | T _{AMB} | 50 | °C | |
| Heat-sink temperature | T _{SINK} | 95 | °C | |

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 | |

General Performance data (All versions)

| Item | Symbol | Min | Typ | Max | Unit | Notes |
|---|--------------------------|--------|--------|--------|------|------------|
| Unregulated Output Voltage Aux | V _{OUT,AUX,REG} | 2 x 16 | 2 x 21 | 2 x 24 | Vdc | See Note 3 |
| 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 | See Note 1 |
| Max Audio Output Power @ 20Hz into amplifier load | P _{RALF} | 1200 | - | - | W | See Note 2 |
| Efficiency | η | | 92 | | % | full power |
| Idle Losses | P ₀ | | 4 | | W | |
| Standby Power | P _{standby} | | TBD | | W | |
| Switching frequency | F _{SW} | | 100 | | kHz | |

General Performance data (SMPS1200A400)

| Item | Symbol | Min | Typ | Max | Unit | Notes |
|----------------|------------------|-----|-----|-----|------|------------|
| Output Voltage | V _{OUT} | TBD | TBD | TBD | Vdc | See Note 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 | See Note 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: Output voltage is proportional to the mains line voltage (Typical 230Vac).

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, $T_a = 25^\circ\text{C}$. Connected amplifier: 2 x UcD700OEMV4, $f = 1\text{kHz}$.

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 $T_{\text{MAX}} = 100^\circ\text{C}$ | P_o | Load = 4Ω 100Vac/60Hz 230Vac/50Hz | | 1200 1200 | | W | |
| Continuous output power. T_{MAX} stabilized at 100°C | P_o | Load = 4Ω 100Vac/60Hz 230Vac/50Hz | | 400 400 | | W | |

Output Power (SMPS1200A400)

Connected amplifier: UcD400OEM[®], $f = 1\text{kHz}$. Distortion figures (THD+N) at the stated power ratings are at 1%.

| Item | Symbol | Conditions | Typ | Unit | Notes |
|---|--------|----------------------------------|------------|------|-------|
| Total amplifier output power at different input voltages. | P_o | 240VAC Load = 4Ω Load = 8Ω | TBD TBD | W | |
| | P_o | 230VAC Load = 4Ω Load = 8Ω | TBD TBD | W | |
| | P_o | 120VAC Load = 4Ω Load = 8Ω | TBD TBD | W | |
| | P_o | 90VAC Load = 4Ω Load = 8Ω | TBD TBD | W | |

Output Power (SMPS1200A700)

Connected amplifier: 2 x UcD700OEM[®], $f = 1\text{kHz}$. Distortion figures (THD+N) at the stated power ratings are at 1%.

| Item | Symbol | Conditions | Typ | Unit | Notes |
|---|--------|----------------------------------|-------------|------|-------|
| Total amplifier output power at different input voltages. | P_o | 240VAC Load = 4Ω Load = 8Ω | 1350 750 | W | |
| | P_o | 230VAC Load = 4Ω Load = 8Ω | 1250 850 | W | |
| | P_o | 120VAC Load = 4Ω Load = 8Ω | 850 615 | W | |
| | P_o | 90VAC Load = 4Ω Load = 8Ω | 575 350 | W | |

J1: Main Output Connections. Connector type: JST-B4P-VH

| Pin | Function |
|-----|---|
| 1 | Positive Bootstrap Driver Voltage (Vdr) |
| 2 | Positive Output Voltage (Vcc) |
| 3 | Output Ground |
| 4 | Output Ground Bootstrap |
| 5 | Negative Output Voltage (Vee) |
| 6 | Negative Bootstrap Driver Voltage (Vdr) |

J2: Mains Input. Connector type: JST-B3P-VH

| Pin | Function |
|-----|-------------|
| 1,3 | Mains Input |
| 2 | * |

* 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>

J3: Mains Voltage Input Selection. Connector type: JST-B2P-VH

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

J4: UcD700/1200 interface. Connector type: 2 x 5Pin Boxheader

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

J5: Aux Voltage & PS Control

| Pin | Function |
|-----|--|
| 1 | SMPS Standby input |
| 2 | AMP Disable input |
| 3 | Positive Unregulated Auxiliary Output Voltage (+21V) |
| 4 | NC |
| 5 | Ground |
| 6 | NC |
| 7 | Negative Unregulated Auxiliary Output Voltage (-21V) |

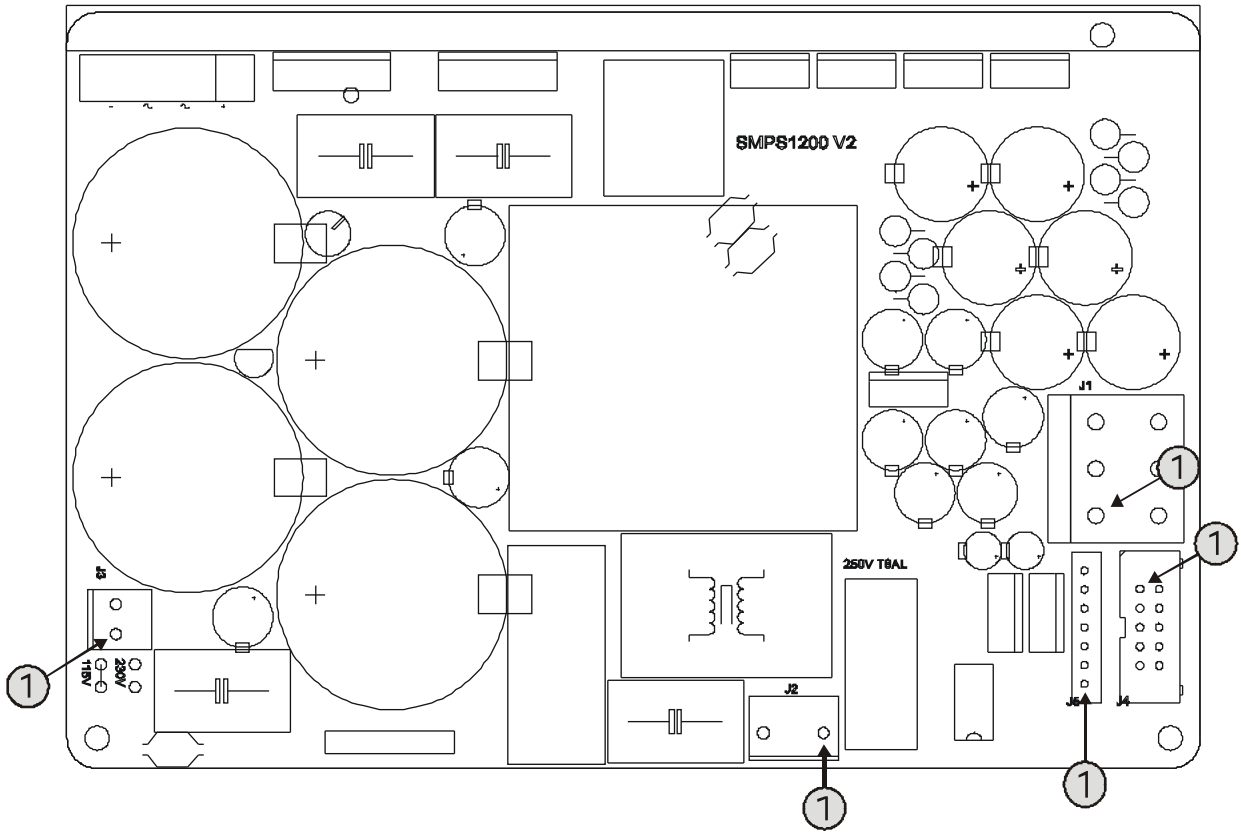


Fig1. Connector pinning SMPS1200.

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 Amplifier.

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

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 | |

Regulated Auxiliary Output Characteristics

The SMPS1200 provides Regulated Auxiliary Output Voltages that are available for external auxiliary purposes.

| Item | Type | Min | Typ | Max | Unit | Notes |
|------------------------------|--------|-----|-----|-----|------|------------|
| Positive DC voltage on J4:10 | output | | 12 | | Vdc | See note 1 |
| Negative DC voltage on J4:9 | output | | 12 | | Vdc | See note 1 |

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

Output Voltage Characteristics SMPS1200A400)

| Item | Type | Min | Typ | Max | Unit | Notes |
|-----------------------------|--------|-----|-----|-----|------|--------------|
| Positive DC voltage on J1:1 | Output | | TBD | | Vdc | See note 1,2 |
| Negative DC voltage on J1:3 | Output | | TBD | | Vdc | See note 1,2 |

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.

Output Voltage Characteristics (SMPS1200A700)

| Item | Type | Min | Typ | Max | Unit | Notes |
|-----------------------------|--------|-----|-----|-----|------|--------------|
| Positive DC voltage on J1:1 | Output | | 85 | | Vdc | See note 1,2 |
| Negative DC voltage on J1:3 | Output | | -85 | | Vdc | See note 1,2 |

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.

Output Grounds Characteristics

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

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 a UcD OEM series amplifier. 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 J4:1 | Input | | | | Vdc | *Use open collector |

* modules can be connected to this pin.

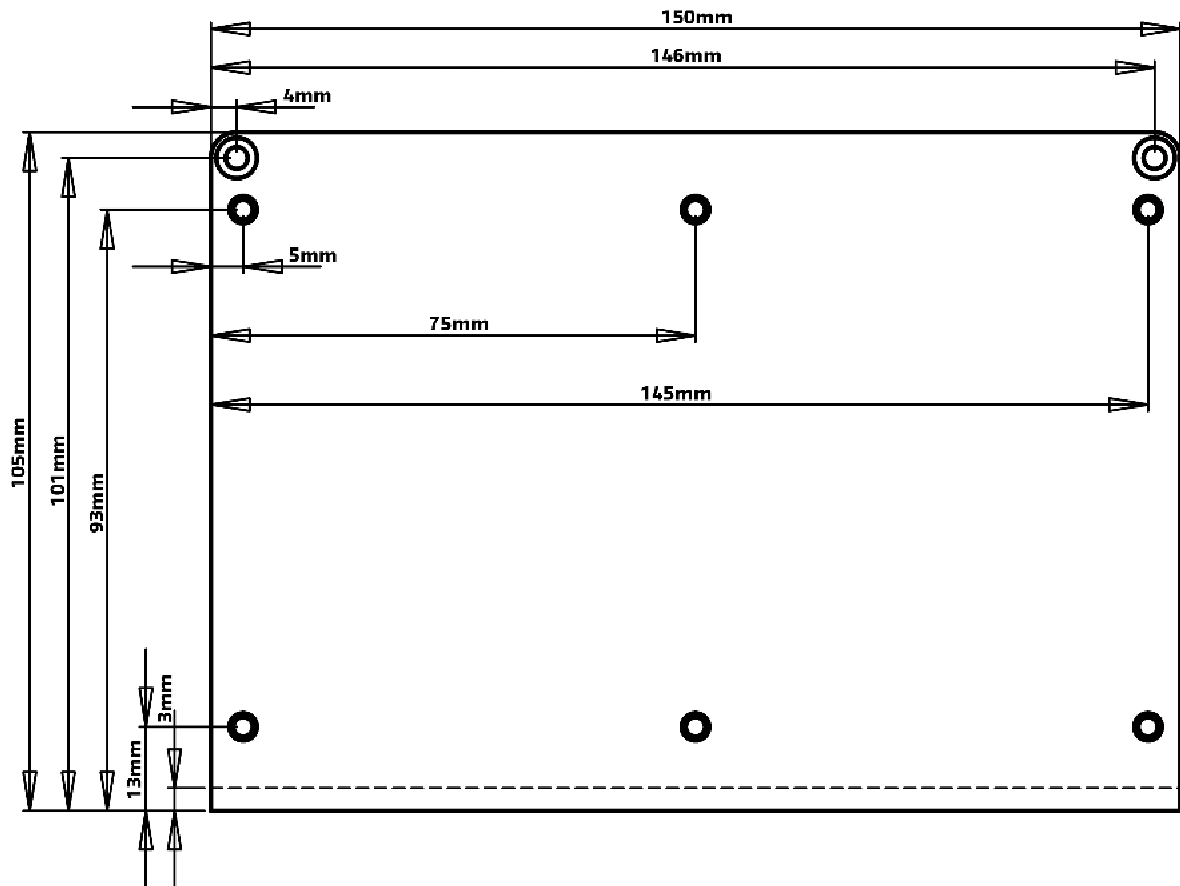
Auto Amplifier Enable Characteristics

When the enable-line of a UcD-series amplifier is connected to this pin the amplifier will be enabled and disabled automatically when the SMPS1200 is switched on and off preventing unwanted audio artefacts during powerup and powerdown.

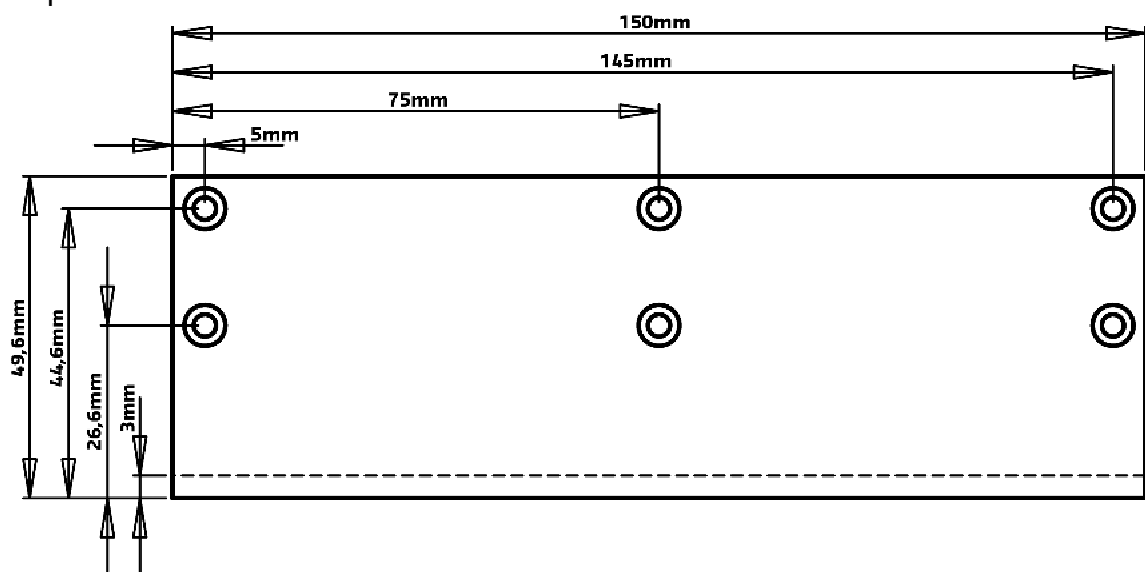
| Item | Type | Min | Typ | Max | Unit | Notes |
|--------------------|--------|-----|-----|-----|------|-------------------------|
| DC voltage on J4:5 | Output | | | | | Internal open collector |

Mounting Dimensions

Bottom view L-profile



Back view L-profile



| Document Revision | PCB Version | Description | Date |
|-------------------|-------------|--|------------|
| R1 | SMPS1200V1 | Initial Draft. Applicable to SMPS1200 V1.0 | 08.06.2009 |
| R2 | SMPS1200V2 | <ul style="list-style-type: none"> - 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 |