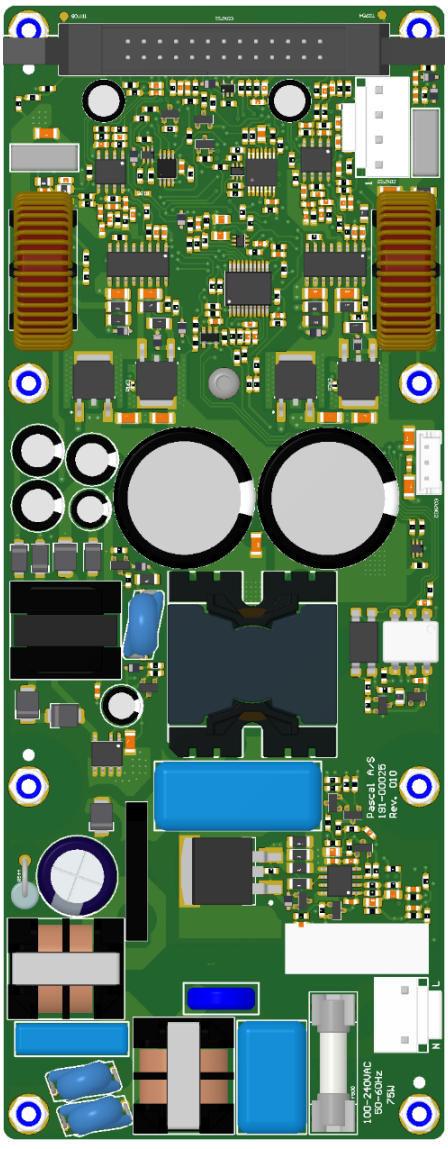
PASCAL

U-PRO2S Amplifier Module

Data Sheet



U-PRO2S Amplifier Module

Content of this data sheet is subject to change without prior notice

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1 Features and description

Features

- 2 x 140W (SE) or 1 x 280W (BTL) amplifier channel(s) using Pascal's UMAC™ technology for unmatched sonic performance
- Universal mains regulated power supply with PFC using Pascal's UREC™ power supply technology
- Auxiliary power supply for external circuitry like DSP Front End solutions
- ErP (1275/2008/EC) & Energy Star compliant standby consumption < 0.5W
- Wake On Music ready with selectable timing
- Full protection scheme
- Ultra-compact size
- Unmatched total system efficiency
- Multiple readouts (temperature, amplifier output voltage, clip monitor, amplifier protect/mute, VAC)
- Safety approved and verified for EMC compliance

Product summary

Parameter	Typical Value
Total Output power (1% THD+N, 1kHz @ 4Ω)	140 W + 140W
Total system efficiency (BTL, 280 W @ 33Ω)	89.5 %
Peak output current CH1 & CH2	25 A
THD+N (1kHz @ 1W)	0.003 %
Dynamic range	119 dB(A)
Idle noise	49 µV(A)
Output resistance (1kHz)	22.5 mΩ
Mains input voltage	$85V_{AC}$ – $265V_{AC}$
Standby consumption	0.23 W

Description

The U-PRO2S series module is a 2 channel Class-D amplifiers with integrated universal mains power supply with PFC.

The U-PRO2S has two symmetric high power channels intended for LF/MF drivers. In addition, the two channels can be configured as one BTL (Bridge Tied Load) output channel, e.g. for sub-woofer setup.

The U-PRO2S module offers an ultra-compact size with an unmatched total system efficiency, to ease the integration of the U-PRO2S modules into any audio solution.

In addition, the U-PRO2S module offers a number of readouts and controls, which allow for external DSP control of the modules. The built-in auxiliary power supply makes it easy to supply the DSP Front End.

Typical applications

- Professional Audio Solutions
- 100/70V Line Applications
- Installation Systems
- Consumer Audio Solutions
- Hi-Fi Audio Solutions
- Self-Powered Loudspeakers
- MI Audio Solutions

2 General specifications

2.1 Audio specifications

Electrical Characteristics @ T_a = 25°C (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{out,max}$	Peak output voltage Ch1 & Ch2	Unloaded	-	± 70	-	V
$V_{out,max(BTL)}$	Peak output voltage Ch1 - Ch2	Unloaded	-	± 140	-	V
$I_{out,peak}$	Peak output current		-	25	-	A
$P_{o,tot}$	Total module output power[1]	230V_{AC} 120V_{AC}	-	280 250	-	W
P_o	Output power @ 1% THD+N, 1kHz[2] Ch1 or CH2, single ended R_L=8Ω	230V_{AC} 120V_{AC}	-	245 245	-	W
P_o	Output power @ 1% THD+N, 1kHz[2] Ch1 or Ch2, single ended R_L=4Ω	230V_{AC} 120V_{AC}	-	280 250	-	W
P_o	Output power @ 1% THD+N, 1kHz[2] CH1+Ch2, single ended R_L=4Ω	230V_{AC} 120V_{AC}	-	2 x 140 2 x 125	-	W
$P_{o(70VRMS)}$	Output power @ 1% THD+N, 1kHz[2] Ch1+Ch2, bridge tied load R_L=20Ω	230V_{AC} 120V_{AC}	-	250 250	-	W
$P_{o(100VRMS)}$	Output power @ 1% THD+N, 1kHz[2] Ch1+Ch2, bridge tied load R_L=33Ω	230V_{AC} 120V_{AC}	-	240 240	-	W
THD+N	THD+N @ 1W, 1kHz, R_L = 8Ω[2]			0.003		%
$V_{noise\ SE}$	Output idle noise - Ch1 & Ch2	Unweighted A-weighted	-	66 49	-	μV_{RMS}
$V_{noise\ BTL}$	Output idle noise – Ch1 - Ch2	Unweighted A-weighted	-	66 49	-	μV_{RMS}
DR_{SE}	Dynamic Range - Ch1 & Ch2	Unweighted A-weighted	-	117 119	-	dB
DR_{BTL}	Dynamic Range – Ch1 - Ch2	Unweighted A-weighted	-	117 119	-	dB
A	Voltage gain @ 1kHz, Ch1 & Ch2 SE / CH1 - Ch2 BTL	SE BTL	-	26 32	-	dB
A_{var}	Frequency response variance Ch1 & Ch2 @ 20Hz – 20kHz	R_L = Open Load R_L = 8Ω R_L = 4Ω $R_{L(BTL)}$ = 33Ω $R_{L(BTL)}$ = 20Ω	-	0.3 0.1 0.3 0.2 0.1	-	dB
BW_{up}	Upper bandwidth @ -3dB Ch1 & Ch2 SE	R_L = Open Load R_L = 8Ω R_L = 4Ω $R_{L(BTL)}$ = 33Ω $R_{L(BTL)}$ = 20Ω	-	105 85 65 90 90	-	kHz
BW_{low}	Lower bandwidth @ -3dB Ch1 & Ch2 SE	All loads	-	1.6	-	Hz
R_o	Output resistance[3]	SE 1 kHz SE 20 kHz BTL 1 kHz BTL 20 kHz	-	22.5 256 43.6 582	-	mΩ
$V_{out,offset}$	Amplifier output DC Offset	SE 4Ω BTL 33Ω	-	±7 ±7	-	mV
IMD_{CCIF}	Intermodulation distortion (CCIF), Ch1 & Ch2 SE	18kHz & 19kHz Po = 10W, 8Ω	-	0.006	-	%
IMD_{TIM}	Transient Intermodulation distortion (TIM), Ch1 & Ch2 SE	Po = 10W, 8Ω	-	0.003	-	%
$IMD_{CCIF(BTL)}$	Intermodulation distortion (CCIF), Ch1 - Ch2 BTL	18kHz & 19kHz Po = 10W, 33Ω	-	0.00015	-	%
$IMD_{TIM(BTL)}$	Transient Intermodulation distortion (TIM), Ch1 - Ch2 BTL	Po = 10W, 33Ω	-	0.0017	-	%

Table 2-1: Audio specifications

Note 1: Maximum total power is limited by the power supply.
Note 2: Measured using the Audio Precision AES-17 filter.

Note 3: Measured using “APx Output Impedance Utility” at the mating part of the output connector, thereby including contact resistance of the connectors.

2.2 Input & output loading

Electrical Characteristics @ T_a = 25°C (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Z_{INPUT}	Input impedance	Balanced Unbalanced	-	7.2 3.6	-	kΩ
$Z_{L,Ch1}$	Loudspeaker nominal impedance range Ch1 or Ch2 Single Ended (SE)	Ch1 or Ch2	4[1]	8	∞	Ω
$Z_{L,BTL}$	Loudspeaker nominal impedance range Ch1+Ch2 Bridge Tied Load (BTL)	Ch1+CH2	8[1]	-	∞	
$Z_{L,BTL(70VRMS)}$	Loudspeaker nominal impedance Ch1+Ch2 Bridge Tied Load (BTL)	$Ch1+CH2_{(70VRMS)}$	-	20	∞	Ω
$Z_{L,BTL(100VRMS)}$	Loudspeaker nominal impedance Ch1+Ch2 Bridge Tied Load (BTL)	$Ch1+Ch2_{(100VRMS)}$	-	33	∞	Ω
$Z_{L,C}$	Maximal purely capacitive loading of amplifier output		-	-	1	µF

Table 2-2: Input and output loading

Note 1: U-PRO2S is fully protected for $Z_L < Z_L$ Min. Connection of loads < Z_L Min is not recommended as a low load impedance in combination with the amplifier current limit will limit maxim output power.

2.3 Audio input/output interfacing

Electrical Characteristics @ T_a = 25°C (unless otherwise specified)

Symbol	Parameter	Value	Unit
$In+_{max}$	Absolute maximum audio input voltage	±20	V_p
$In-_{max}$	Absolute maximum audio input voltage	±20	V_p
In+ In-	Audio input voltage (In+) – $(In-)_{max}$ for full output voltage swing	±3.5[1]	V_p

Table 2-3: Audio input voltage rating

Note 1: Internal input stage is supplied from an internal ±5V.

2.4 AC Mains & thermal specification

Electrical Characteristics @ T_a = 25°C (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{AC} Range	Operational voltage range	45Hz - 65Hz	85	-	265	V_{AC}
$P_{120VAC\ NS}$	Mains power input No signal applied	Standby Mute Idle	-	0.17 2.9 5.1	-	W_{RMS}
$P_{230VAC\ NS}$	Mains power input No signal applied	Standby Mute Idle	-	0.22 3.2 5.8	-	W_{RMS}
$P_{120VAC\ NS}$	Mains power input No signal applied Pascal U-PRO I/O-board attached.	Standby Mute Idle	-	0.37 4.4 6.0	-	W_{RMS}
$P_{230VAC\ NS}$	Mains power input No signal applied Pascal U-PRO I/O-board attached.	Standby Mute Idle	-	0.43 4.7 6.5	-	W_{RMS}
P_{AC_PN}	Mains power input 230V_{AC} Both channels driven (SE), Pink Noise $P_{out,RMS}$ = 2 x 1/8th 140W	R_L = 8Ω R_L = 4Ω	-	49 53	-	W_{RMS}
P_{AC_PN}	Mains power input 120V_{AC} Both channels driven (SE), Pink Noise $P_{out,RMS}$ = 2 x 1/8th 125W	R_L = 8Ω R_L = 4Ω	-	45 49	-	W_{RMS}
P_{AC_PN}	Mains power input 230V_{AC} Both channels driven (BTL), Pink Noise $P_{out,RMS}$ ch1 – ch2 = 1/8th 250W	R_L = 33Ω R_L = 20Ω	-	44 46	-	W_{RMS}
P_{AC_PN}	Mains power input 120V_{AC} Both channels driven (BTL), Pink Noise $P_{out,RMS}$ ch1 – ch2 = 1/8th 250W	R_L = 33Ω R_L = 20Ω	-	43 45	-	W_{RMS}
P_{Loss}	Module power loss at 230V_{AC} Ch1+Ch2 (SE), Pink Noise $P_{out,RMS}$ = 2 x 1/8th 140W	R_L = 8Ω R_L = 4Ω	-	14 18	-	W_{RMS}
P_{Loss}	Module power loss at 120V_{AC} Ch1+Ch2 (SE), Pink Noise $P_{out,RMS}$ = 2 x 1/8th 125W	R_L = 8Ω R_L = 4Ω		13 16		W_{RMS}
P_{Loss}	Module power loss 230V_{AC} Ch1 – Ch2 (BTL), Pink Noise $P_{out,RMS}$ ch1 – ch2 = 1/8th 250W	R_L = 33Ω R_L = 20Ω		12 13		W_{RMS}
P_{Loss}	Module power loss 120V_{AC} Ch1 – Ch2 (BTL), Pink Noise $P_{out,RMS}$ ch1 – ch2 = 1/8th 250W	R_L = 33Ω R_L = 20Ω		11 12		W_{RMS}
$\eta_{tot,8\Omega}$	System efficiency @ 2 x 8Ω $P_{out,RMS}$ = 2 x 1/8th 125W	230V_{AC} 120V_{AC}	-	86 84	-	%
$\eta_{tot,4\Omega}$	System efficiency @ 2 x 4Ω $P_{out,RMS}$ = 2 x 1/8th 125W	230V_{AC} 120V_{AC}	-	81 80	-	%
$\eta_{tot,33\Omega*}$	System efficiency @ 33Ω Hi Z $P_{out,RMS}$ ch1 – ch2 = 1/8th 250W @ 1kHz	230V_{AC} 120V_{AC}	-	89 86	-	%
$\eta_{tot,20\Omega*}$	System efficiency @ 20Ω Hi Z $P_{out,RMS}$ ch1 – ch2 = 1/8th 250W @ 1kHz	230V_{AC} 120V_{AC}	-	87 85	-	%
$PF_{4\Omega}$	Power Factor @ 2 x 4Ω Pout,RMS 2 x 50W @ 1kHz	230V_{AC} 120V_{AC}	-	0.92 0.97	-	
$PF_{34\Omega(BTL)}$	Power Factor @ 33Ω(BTL) $P_{out,RMS}$ 100W @ 1kHz	230V_{AC} 120V_{AC}	-	0.92 0.97	-	
T_{SD}	Temperature @ thermal shutdown Thermal hysteresis = 5°C[1]		-	85	-	°C

Table 2-4: AC Mains & thermal specifications

Note 1: 5°C but minimum 10s.

2.5 Auxiliary power supply specification

Electrical Characteristics @ T_a = 25°C (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{+7.5V}$	+7.5V voltage			7.7		V
V_{+15V}	+15V voltage			15.5		V
V_{-15V}	-15V voltage			-15.5		V
V_{Drive}	Vdrive voltage	Ref. to -70V		12.4		V
$I_{+7.5V}$	+7.5V current rating[2]		0		800	mA
I_{+15V}	+15V current rating[2]		0		250	mA
I_{-15V}	-15V current rating[2]		-250		0	mA
I_{VDrive}	V_{Drive} current rating[2]		0		200	mA
P_{tot}	Maximum total output power[2]		0		9	W

Table 2-5: Auxiliary power supply specification

Note 1: For details see U-PRO2S Application Manual

Note 2: The Auxiliary power supply can't be loaded with the maximum rated load current for all four outputs simultaneously as this will violate the 9 Watt total output power limit. Use the typical Voltage levels from *Table 2-5* in combination with the actual load currents to calculate the total power consumption. The calculated total power consumption must comply with the 9 Watt total output power limit.

3 Audio measurements

3.1 Frequency response Ch1 or Ch2 (SE)

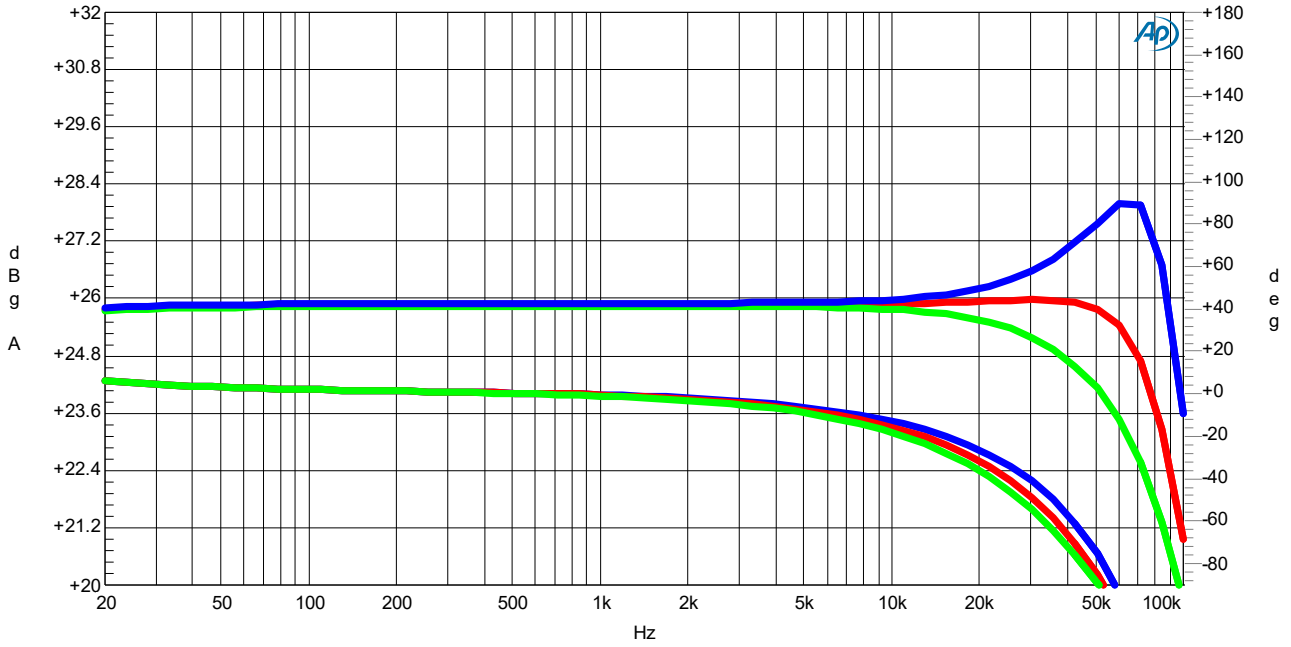

Figure 3-1: Frequency response (Top curves: Amplitude, Bottom curves: Phase)
4Ω (green), 8Ω (red) and Open Load (blue)

3.2 Frequency response Ch1 – Ch2 (BTL)

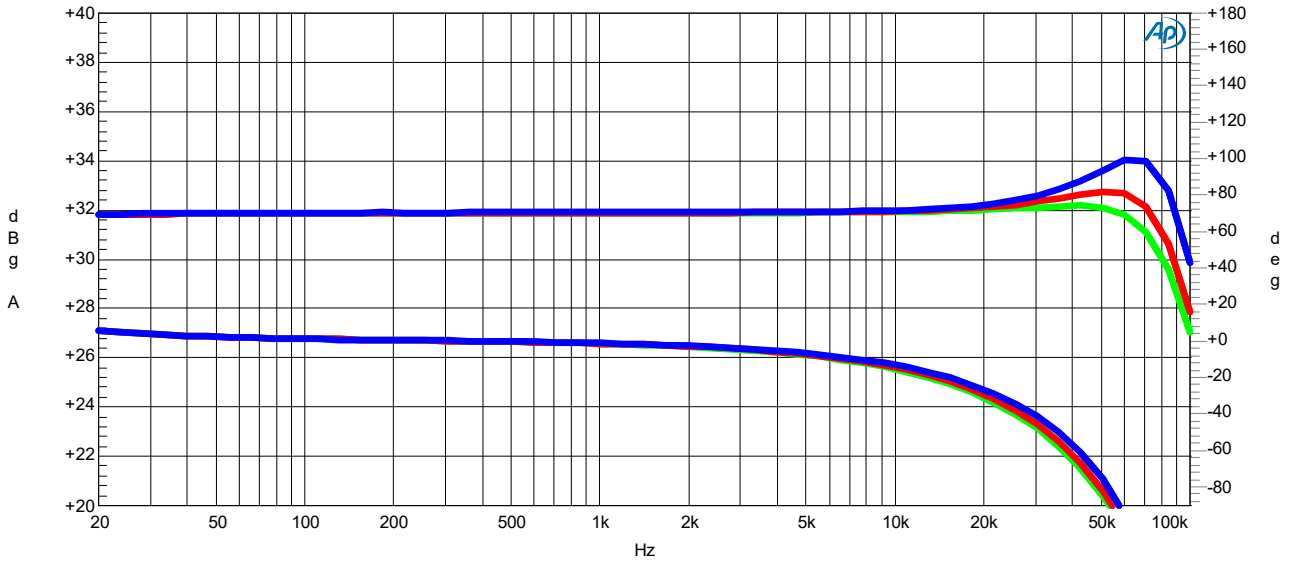

Figure 3-2: Frequency response (op curves: Amplitude, Bottom curves: Phase)
20Ω (green), 33Ω* (red) and Open Load (blue)*

3.3 Total Harmonic Distortion + Noise (THD+N) Ch1 or CH2 (SE)

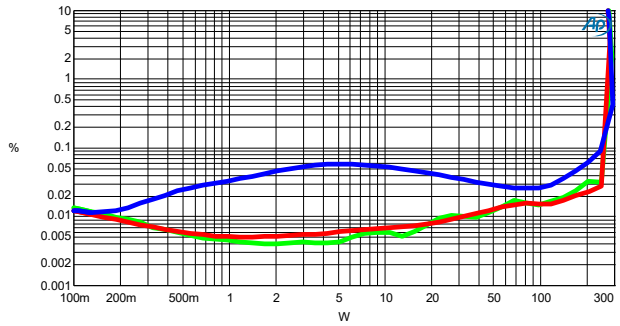

Figure 3-3 THD+N vs. Power @ 4Ω, 230V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

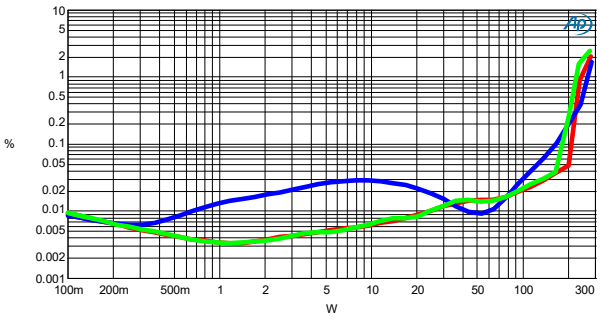

Figure 3-4 THD+N vs. Power @ 8Ω, 230V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

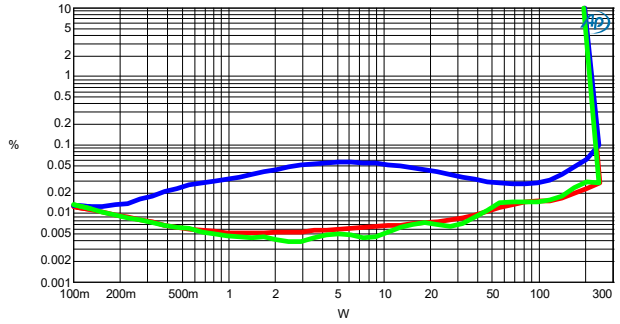

Figure 3-5 THD+N vs. Power @ 4Ω, 120V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

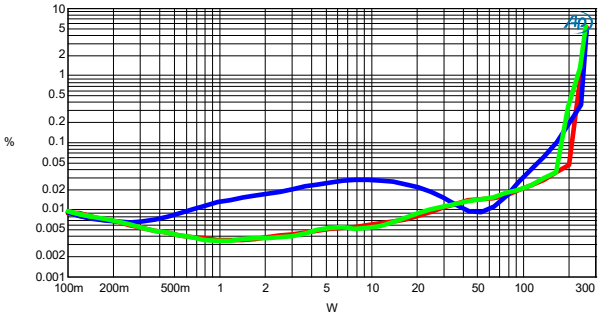

Figure 3-6 THD+N vs. Power @ 8Ω, 120V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

3.4 Total Harmonic Distortion + Noise (THD+N) Ch1 – Ch2 (BTL)

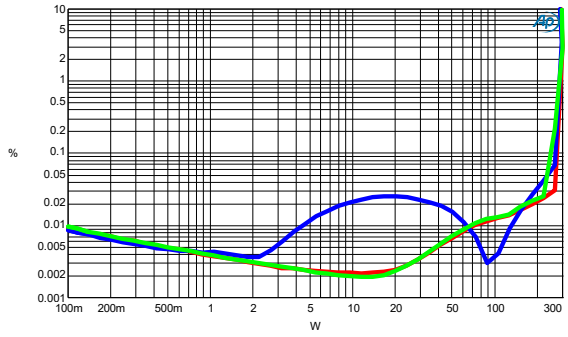

Figure 3-7: THD+N vs. Power@ 18Ω, 230V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

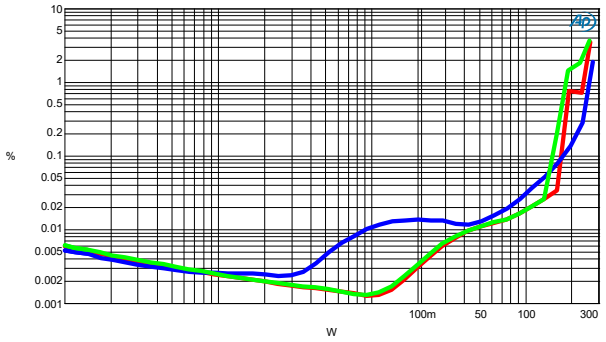

Figure 3-8: THD+N vs. Power @ 33Ω, 230V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

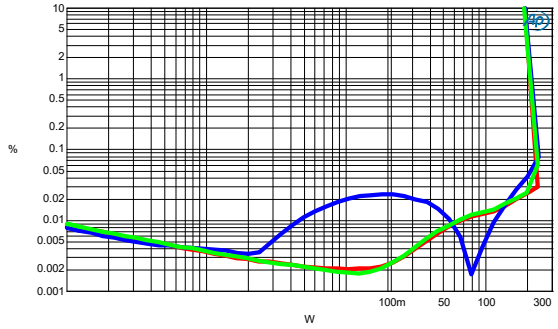

Figure 3-9: THD+N vs. Power@ 20Ω, 120V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

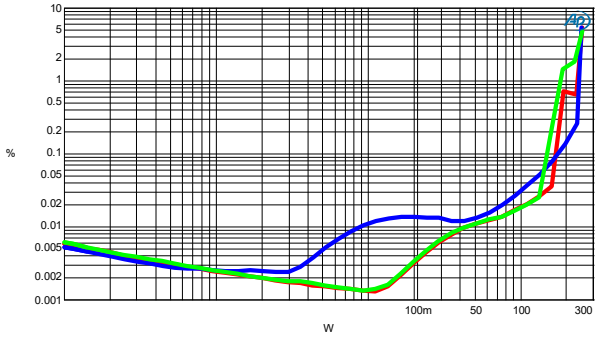

Figure 3-10: THD+N vs. Power @ 33Ω, 120V$_{AC}$
100Hz (green), 1kHz (red), 6.67kHz (blue)

3.5 Noise spectrum

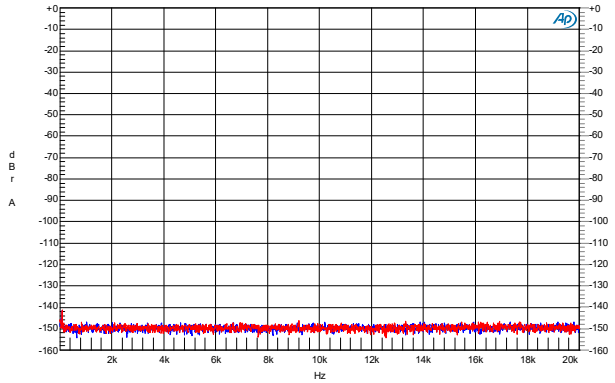

Figure 3-11: FFT idle - 8Ω SE
Ch1 (blue) & Ch2 (red)

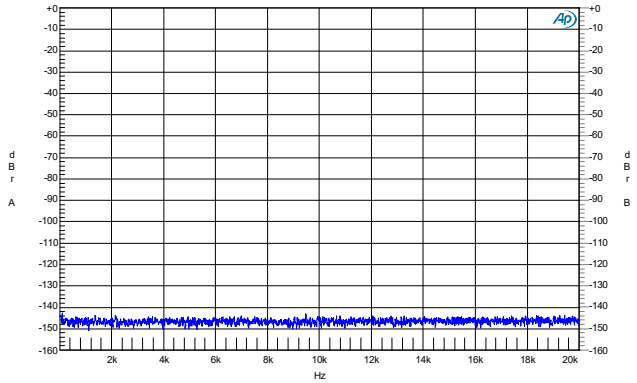

Figure 3-12: FFT idle - 33Ω BTL
Ch1-Ch2

3.6 Intermodulation Distortion (CCIF, TIM) Ch1 or Ch2 (SE)

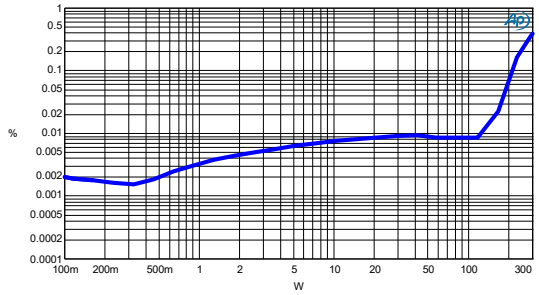

Figure 3-13: CCIF vs. Power - R_L=4Ω
f_1=18kHz, f_2 =19kHz, 230V_{AC} Ch1 (blue)

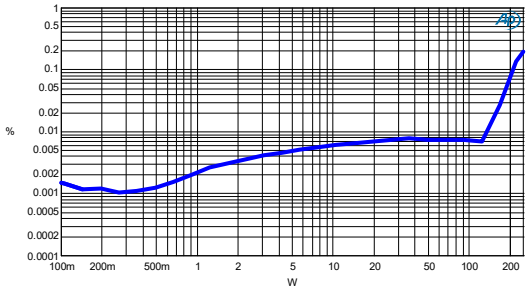

Figure 3-14: CCIF vs. Power - R_L=8Ω
f_1=18kHz, f_2 =19kHz, 230V_{AC} Ch1 (blue)

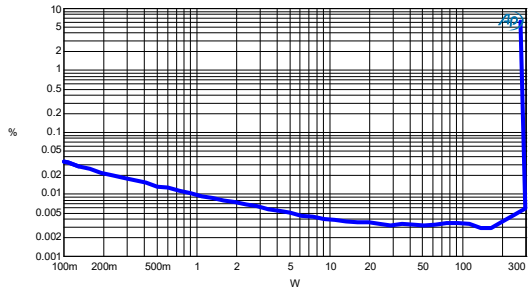

Figure 3-15: TIM vs. Power - R_L=4Ω, 230V_{AC} Ch1 (blue)

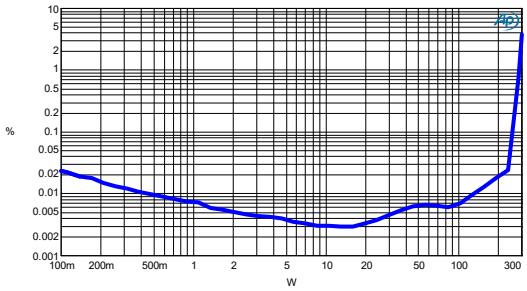

Figure 3-16: TIM vs. Power - R_L=8Ω, 230V_{AC} Ch1 (blue)

3.7 Intermodulation Distortion (CCIF, TIM) Ch1 – CH2 (BTL)

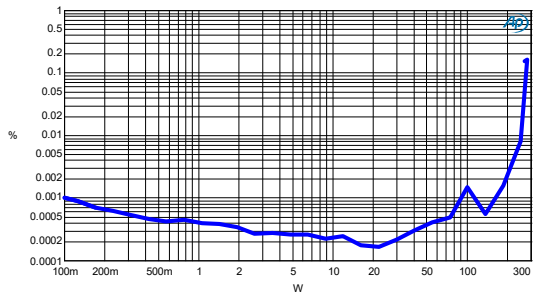

Figure 3-17 CCIF vs. Power - R_L=20Ω
f_1=18kHz, f_2 =19kHz, 230V_{AC} Ch1-Ch2

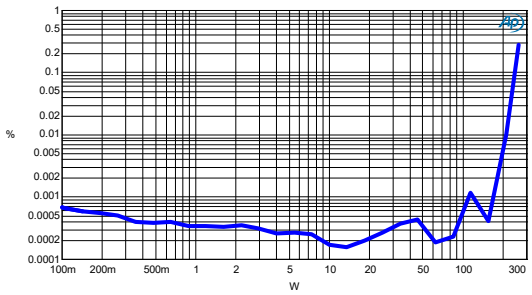

Figure 3-18 CCIF vs. Power - R_L=33Ω
f_1=18kHz, f_2 =19kHz, 230V_{AC} Ch1-Ch2

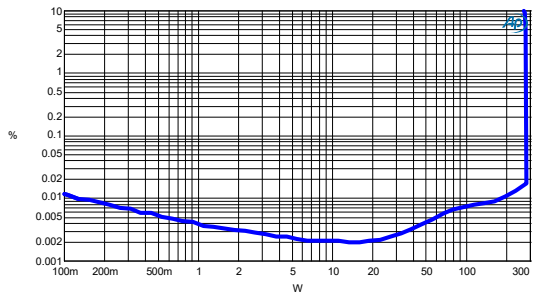

Figure 3-19 TIM vs. Power - R_L=20Ω, 230V_{AC} Ch1-Ch2

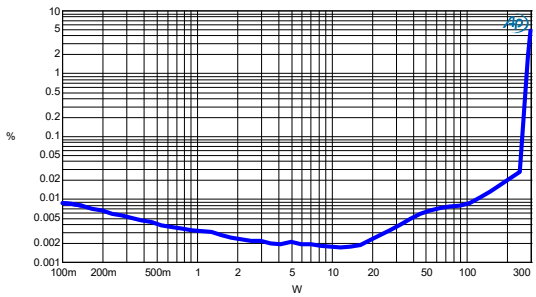

Figure 3-20 TIM vs. Power - R_L=33Ω, 230V_{AC} Ch1-Ch2

3.8 Cross talk & output resistance

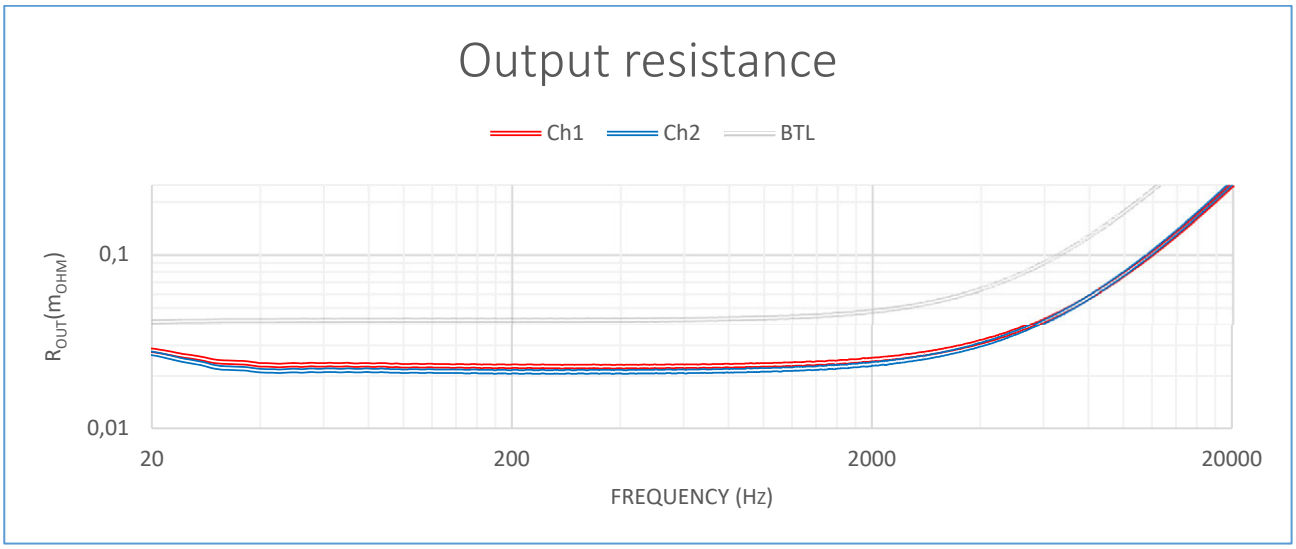

Figure 3-21: Output resistance – Measurement made at the mating part of the output connector. Connector resistance thereby included. Ch1 (red), Ch2 (blue), Ch1+Ch2 (grey)

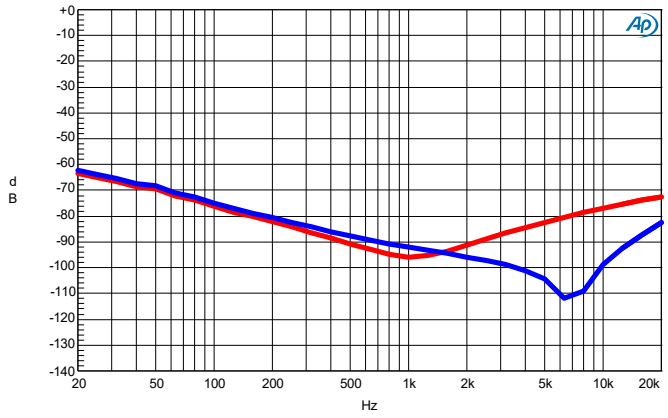

Figure 3-22: Cross talk - Ch.1 @ Po, ch2=50W 8Ω (red), Ch.2 @ Po, ch1=50W 8Ω (blue)

3.9 Output voltage vs. frequency

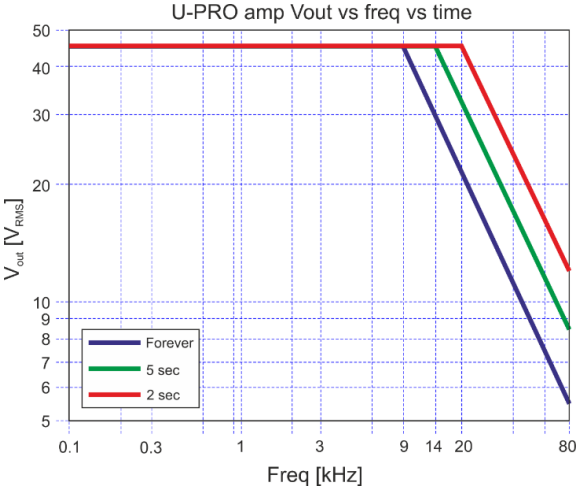

Figure 3-23: Max Vout vs. frequency vs. time

4 Control and readout specification

4.1 Control pins

$\overline{\text{Mute}}$ – When muting the U-PRO2S module, the amplifier outputs will be disabled. It typically takes 0.5ms to disable and only 1ms to enable the amplifier.

The mute function may be used with an external wake-on-music circuitry to lower the mains power consumption when the module is unused, but still with the module ready to play in typically 1ms – making it unnoticeable for the user.

$\overline{\text{Standby}}$ – With the U-PRO2S module in standby the mains power consumption is put to a minimum. In standby it is possible to comply to the ErP (1275/2008/EC) & Energy Star with a total power consumption of less than 0.5W. This includes a current draw of up to 25 mA on the +7.5V supply for external standby control circuitry.

Signal_Present – This signal is part of the “Wake On Music” function built into the U-PRO2S modules. If left open the signal is internally pulled high and “Wake On Music is not used”. If pulled low continuously for a selectable amount of time set by the “Signal Time Out Select” the amplifiers will first be muted to save power but are still able to be un-muted within 1ms. If the signal present continues to be low the U-PRO2S module will enter standby mode. The U-PRO2S module exits standby mode as soon as the signal present signal is released and is ready within typically 660ms.

A suitable circuit for sensing the audio with a sensitivity of $4mV_{rms}$ and controlling the Signal Present pin can be found in the U-PRO2S Series Application Manual.

Signal_TimeOut – This signal is part of the “Wake On Music” function built into the U-PRO2S module. Placing a resistor from this pin to GND makes it possible to choose between 3 different timing settings. See the U-PRO2S Series Application Manual for details.

T-V_Sel/SMPS_OL – This pin can be either an input or an output depending on the selected timing resistors connected to the Signal_TimeOut (pin 14) described above. In the Temp/VAC mode, it will be an input pin – possible to toggle – allowing to readout both the mains voltage and amplifier temperature real-time. In the Low Rail mode, it is an output pin indicating whether the rail voltages (+/- 70V) are below 50V, or not – useful for a Front End circuitry to activate a limiter avoiding the rail voltage to be pulled below the level where sound will disappear temporarily.

4.2 Readout pins

The U-PRO2S has various readouts to monitor the state of the module.

Temp/VAC_Out – Amplifier temperature or mains voltage readout – By toggling a control-pin, either mains voltage or amplifier temperature can be read real-time.

- *Amplifier temperature* – The output stage temperature from 0-100° is expressed as a DC voltage from 0-3.3V. When the module enters thermal protection at 85° equivalent to 2.805V the voltage will jump to 3.3 V indicating thermal protection is active. This makes it possible to both read the live temperature and read when the module is disabled due to thermal protection. The module exits thermal protection when the temperature drops below 80° and the voltage will return to a live readout of the actual module temperature.

- *Mains voltage* – The AC mains voltage from 85-265V_{AC} is expressed as a DC voltage from 0.213V to 2.925V. This readout may be used to adjust external limiters to match the mains voltage dependent output power.

Amplifier Output Voltage readout – There are two amplifier output voltage readouts Vout_Monitor_Ch1 and Vout_Monitor_Ch2 - one for each channel. These readouts are voltage divisions of the output signals in the range of ±10 Vp corresponding to ±70Vp at the output.

Amplifier Clip readout – There are two amplifier clip readouts – $\overline{\text{Clip\_1}}$ and $\overline{\text{Clip\_2}}$. These readouts are open-collector outputs. The readout pins will be pulled low if the audio output voltage for Ch1 or Ch2 (respectively) becomes too high, compared to the internal rail voltages, or if the Ch1 and/or Ch2 amplifier reaches internal current protection. These readouts may be used for signal clip/limiting indications.

$\overline{\textbf{Dis\_Read/Protect}}$ – This readout is an open-collector output which will be pulled low when the module is either muted or has entered an internal protection.

5 Protection features

The U-PRO2S has built-in protection features to protect the amplifier module against abuse and/or extreme use scenarios, and to protect the speaker drivers from being damaged in case of a malfunction.

Temperature – Temperature protection of the power supply and amplifiers is implemented to prevent the module from thermal runaway. When thermal protection is engaged both amplifiers are muted until the temperature has dropped 5°C or minimum 10s.

Over Current – If an amplifier output is shorted or reaches its current limit, the clip readout will be activated to allow an external limiter/DSP to limit the input signal. If the limiter is not capable of limiting the signal, the module will enter over-current protection and mute both amplifier outputs, until the internal protection timing allows the module to re-enable the amplifier(s).

DC Protection – If DC-voltage is detected at one of the amplifier outputs, the U-PRO2S module mutes the outputs. If DC still is present after 3 cycles, the U-PRO2S DC protection circuit switch off the +/-70V power supply. To reset the latched protection circuit, an AC-recycling of the amplifier module is required.

HF Protection – A high frequency protection is implemented in order to protect the amplifier output filter components from overload – refer to *Figure 3-23*. If a high frequency (and high amplitude) signal is present for a longer period of time, the module will enter HF protection and mute both amplifier outputs, until the internal protection timing allows the module to re-enable the amplifier(s).

5.1 U-PRO2S functional blocks

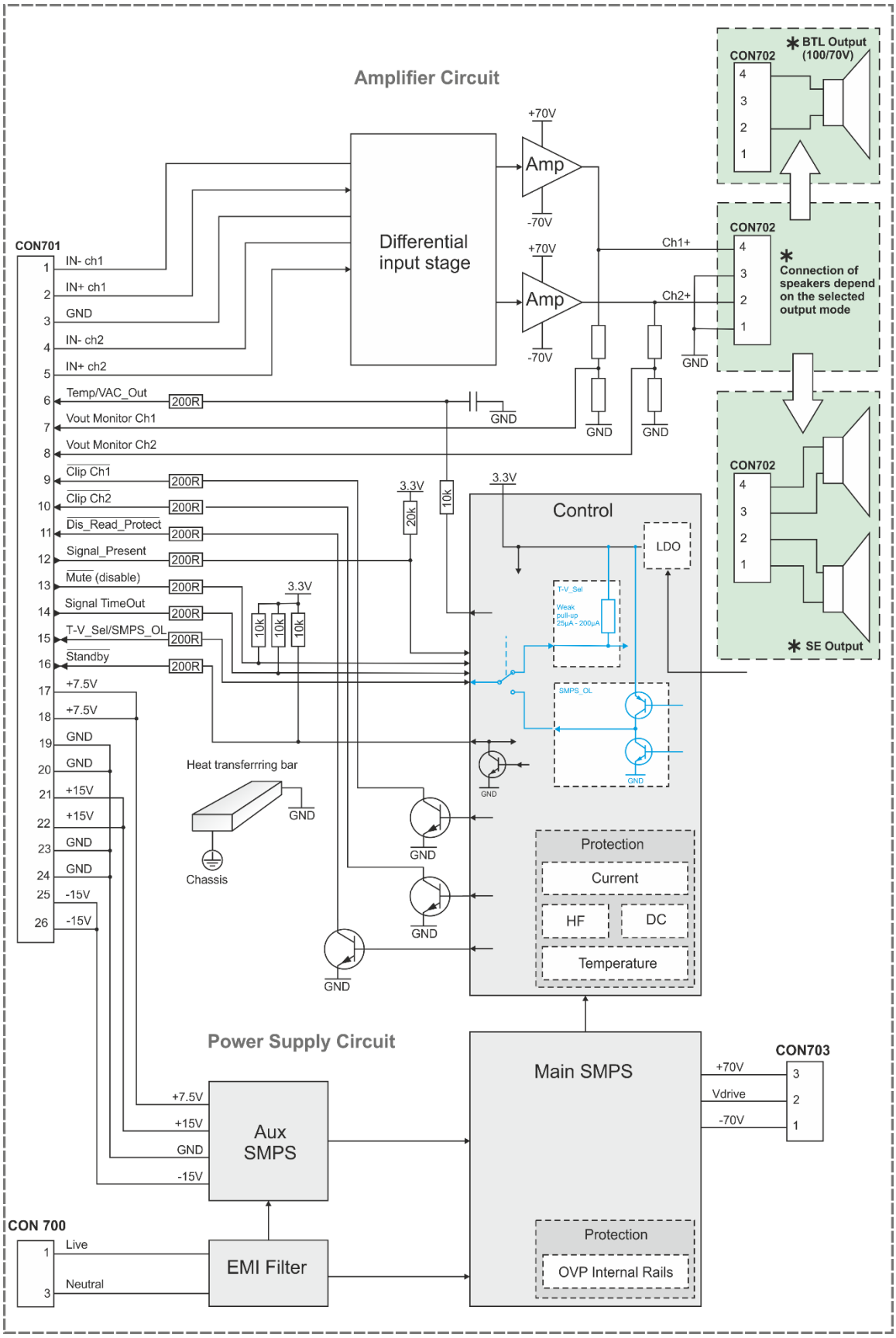

Figure 5-1: Block diagram showing U-PRO2S module functionality

5.2 Single Ended (SE) 2 channel configuration

The two symmetrical amplifier channels available on the U-PRO2S module, can be configured as two single ended output channels.

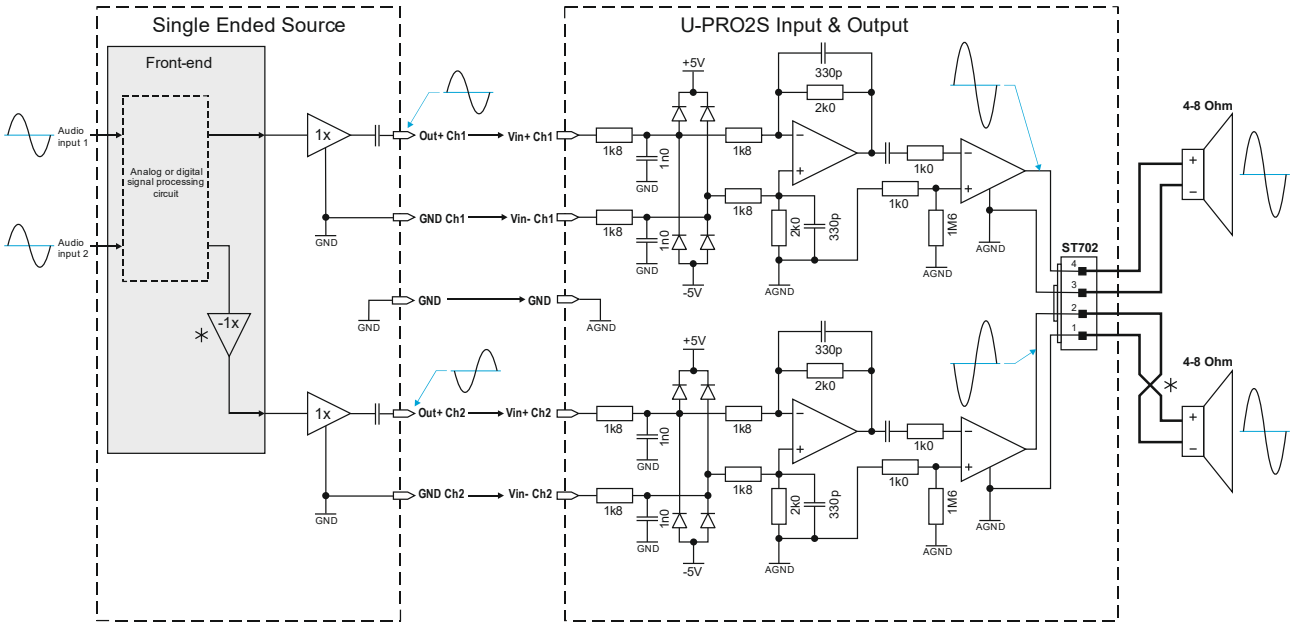

Figure 5-2: U-PRO2S Amplifier module shown in Single Ended (SE) configuration driving two identical LF/MF loads

NOTICE The * marking in *Figure 5-2*, indicates that input and output of channel 2 must be inverted to reduce pumping.

5.3 Bridge Tied Load (BTL) configuration

The two symmetrical amplifier channels available on the U-PRO2S module, can alternatively be configured as one bridge tied output channel, e.g. for subwoofer setup.

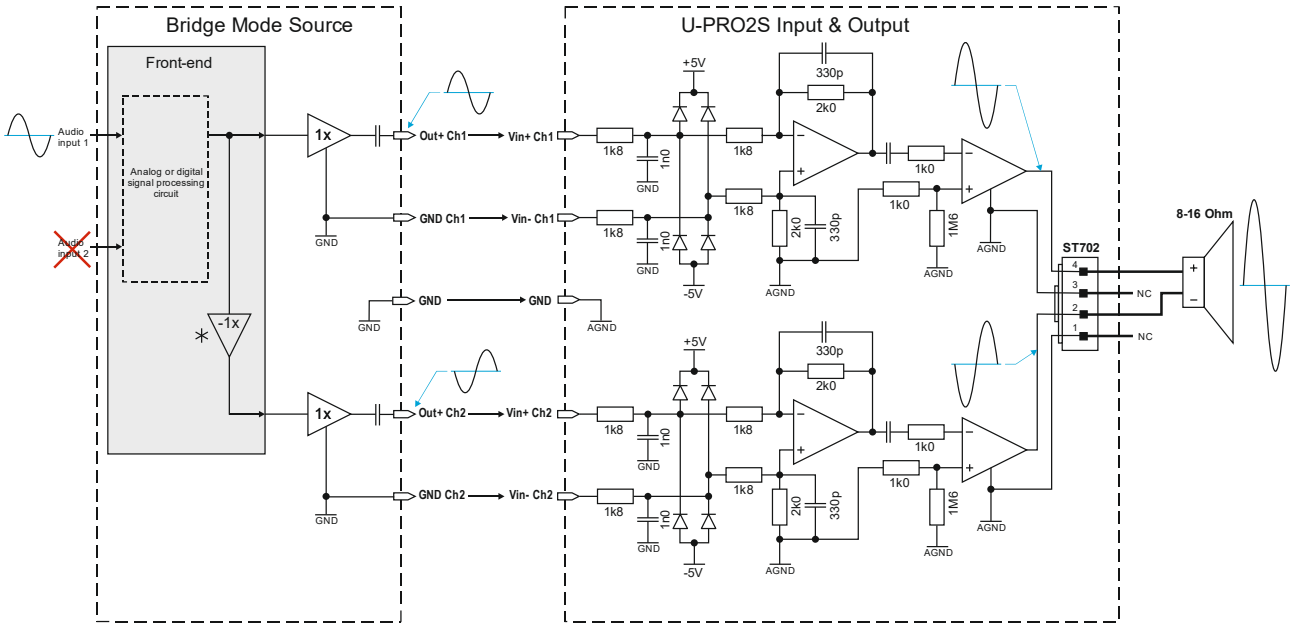

Figure 5-3: U-PRO2S Amplifier module shown in Bridge Tied Load (BTL) configuration driving one subwoofer

NOTICE The * marking in *Figure 5-3*, indicates that input for channel 2 must be inverted in the Front End to produce the negative swing of the bridge tied output.

For 100V/70V applications the two channels can be configured as one bridge tied load for Hi-Z output.

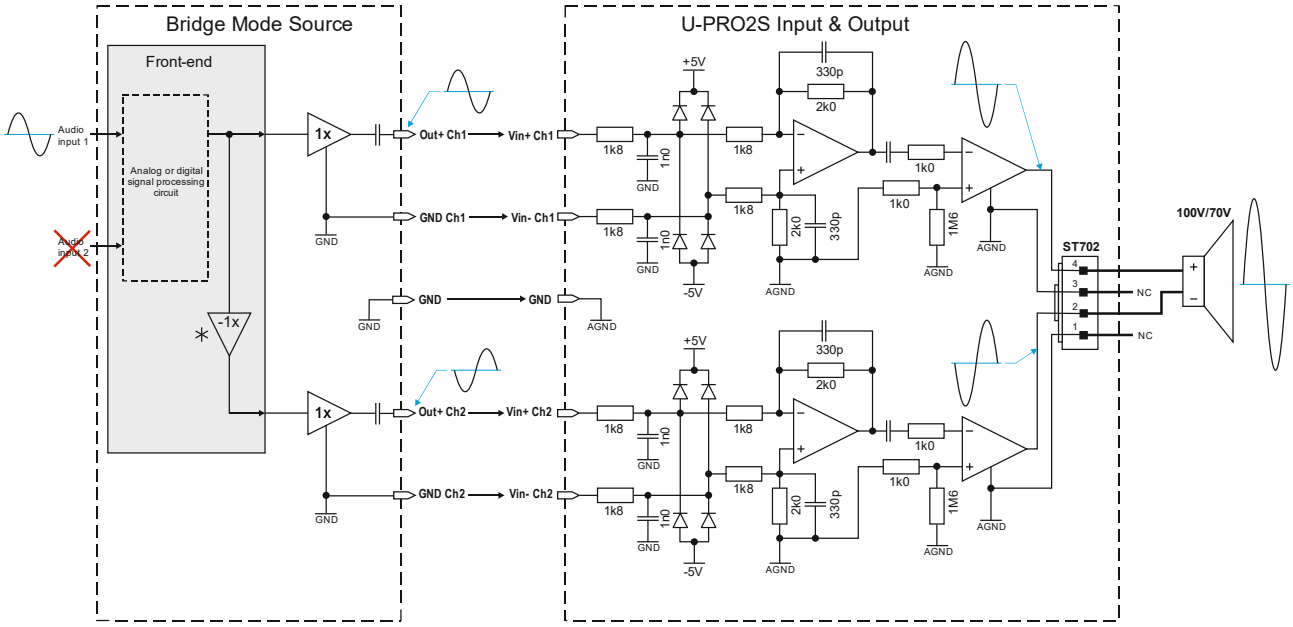

Figure 5-4: U-PRO2S Amplifier module shown in Bridge Tied Load (BTL) configuration driving one 100V/70V line

NOTICE The * marking in *Figure 5-4*, indicates that input for channel 2 must be inverted in the Front End to produce the negative swing of the bridge tied output.

6 U-PRO2S connections

This section describes the signal, control and DC-supply connections of the U-PRO2S module.

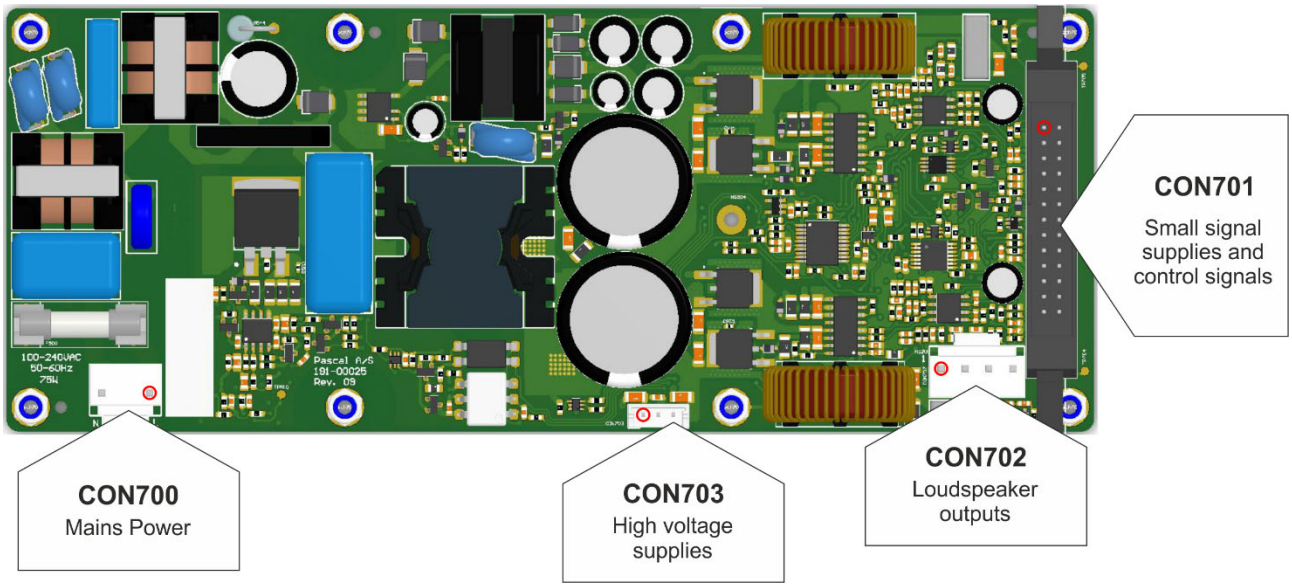

Figure 6-1: U-PRO2S Amplifier module connectors – red circle indicates pin 1

6.1 Mains Power connector

CON700			Description
Name	**Pin #**	**I/O**	
L	1	I	The mains input Live/Line wire must be connected to this terminal.
N	2	I	The mains input Neutral wire must be connected to this terminal.

Table 6-1: U-PRO2S Mains connector

6.2 Signal and Control connector

CON701			Description
Name	**Pin #**	**I/O**	
Ch1_In-	1	I	Ch 1 negative audio input signal of the balanced input to the U-PRO2S/U-PRO2SD module. The maximum allowable signal on this pin is $\pm 20V_p$.
Ch1_In+	2	I	Ch 1 positive audio input signal of the balanced input to the U-PRO2S/U-PRO2SD module. The maximum allowable signal on this pin is $\pm 20V_p$.
GND	3	-	This pin is a general purpose GND. Shall be connected to Front End ground plane.
Ch2_In-	4	I	Ch 2 negative audio input signal of the balanced input to the U-PRO2S/U-PRO2SD module. The maximum allowable signal on this pin is $\pm 20V_p$.
Ch2_In+	5	I	Ch 2 positive audio input signal of the balanced input to the U-PRO2S/U-PRO2SD module. The maximum allowable signal on this pin is $\pm 20V_p$.
Temp/Vac_Out	6	O	This pin reads out by default the highest temperature of the two amplifier channels or the +/-70V power supply rectifier diodes in the range of 0-3.3V corresponding to 0°C-100°C. The pin will readout 3.3V when in temperature protection. This pin can alternatively be used to read out the AC mains voltage from 85-265V_{AC} is expressed as a DC voltage from 0.213V to 2.925V. Temp/VAC_Set via pin 15 is used to select either temperature (default) or AC mains readout.

Vout_Monitor_Ch1	7	O	This pin reads out the amplifier channel 1 output voltage. The signal will be in the range ±10V_p corresponding to ±70V_p on the output of the amplifier. The signal has a high impedance and requires a buffer if used.
Vout_Monitor_Ch2	8	O	This pin reads out the amplifier channel 2 output voltage. The signal will be in the range ±10V_p corresponding to ±70V_p on the output of the amplifier. The signal has a high impedance and requires a buffer if used.
$\overline{\text{Clip\_1}}$	9	O	This pin signals an active low whenever the amplifier Ch1 is voltage clipping or current clipping.
$\overline{\text{Clip\_2}}$	10	O	This pin signals an active low whenever the amplifier Ch2 is voltage clipping or current clipping.
$\overline{\text{Dis\_Read/Protect}}$	11	O	This pin signals an active low whenever the amplifier channel 1 and channel 2 are disabled or in protection.
Signal_Present	12	-	This signal is part of the "Wake On Music" function built into the U-PRO series modules. If left open the signal is internally pulled high and "Wake On Music is not used". If pulled low continuously for a selectable amount of time set by the "Signal Time Out Select" the amplifier(s) will first be muted to save power but still be able to un-mute within 1ms. If the signal present continues to be low the U-PRO series module will enter standby mode. The U-PRO2SS Series module exits standby mode as soon as the signal present signal is released and is ready within typically 660ms.
$\overline{\text{Mute}}$	13	I	An open-collector must be used to actively pull this pin low, whenever the module must disable/$\overline{\text{Mute}}$. When released the module is ready within typical 1 ms.
Signal_TimeOut	14	I	3 different power safe mode timings can be selected by connecting a resistor of a specified value to from the Signal_TimeOut pin to GND. See *Table 6-3* for a list of resistor values and corresponding timings. If the Signal Present input is not used the Signal_TimeOut can be left unconnected.
T-V_Sel/SMPS_OL	15	I	This pin can be either an input or an output depending on the selected timing resistors connected to the Signal_TimeOut (pin 14). If timing resistor T1, T2 or T3 is selected (see *Table 6-3)* – it will be an input pin where it is possible to select either temperature or AC mains readout for the signal Temp/Vac_Mon (pin 6). If pin 15 is left un-connected, the internal pull-up will by default select, temperature as the read out on pin 6. If pin 15 is actively pulled low by an open-collector, the mains RMS voltage will be the readout on pin 6. If timing resistor T1(Low Rail), T2(Low Rail) or T3(Low Rail) is selected (see *Table 6-3)* – it will be an output pin that indicates whether the rail (+/-70V) voltage is below +/-50V, or not.
$\overline{\text{Standby}}$	16	I/O	An open-collector must be used to actively pull this pin low, whenever the module must enter standby mode. When released the module is ready within a few seconds.
+7.5V	17,18	O	This pin may be used to supply external circuitry.
GND	19,20	-	This pin is the +7.5V ground return.
+15V	21,22	O	This pin may be used to supply external circuitry.
GND	23,24	-	This pin is the ±15V ground return.
-15V	25,26	O	This pin may be used to supply external circuitry.

Table 6-2: U-PRO2S signal and control connector

It is possible to select one of 3 different Mute/Standby timings by connecting a resistor of a specified value between the Signal_TimeOut (pin 14) and a GND pin. See Table 6-3, to select resistor value that corresponds with the standby time you need.

Timing ID	Resistor (Ω)	Mute time	Standby time	T-V_Sel/SMPS_OL function
T1	≥ 150K	2 min mute	10 min standby	Input – Temp/VAC selection
T2	100k	10 min mute	Never enters standby mode	Input – Temp/VAC selection
T3	68k	10 min mute	25 min standby	Input – Temp/VAC selection
T1(Low Rail)	47K	2 min mute	10 min standby	Output – Low Rail indication
T2(Low Rail)	33K	10 min mute	Never enters standby mode	Output – Low Rail indication
T3(Low Rail)	24K	10 min mute	25 min standby	Output – Low Rail indication

Table 6-3: Mute/Standby timing and Temp–VAC/Low Rail indication resistor selection

6.3 Speaker Output connector

CON702			Description
Name	**Pin #**	**I/O**	
Ch2_Out-	1	O	This pin is used for the GND signal of the channel 2 speaker.
Ch2_Out+	2	O	The amplified speaker signal of channel 2 is available on this pin.
Ch1_Out-	3	O	This pin is used for the GND signal of the channel 1 speaker.
Ch1_Out+	4	O	The amplified speaker signal of channel 1 is available on this pin.

Table 6-4 U-PRO2S speaker connector overview

6.4 DC-Supply connector

CON703			Description
Name	**Pin #**	**I/O**	
-70V	1	O	The negative rail voltage for U-A Series Extension Module is available on this pin.
V_{drive}	2	O	The V_{drive} voltage for U-A Series Extension Module is available on this pin.
+70V	3	O	The positive rail voltage for U-A Series Extension Module is available on this pin.

Table 6-5 U-PRO's U-A Series Extension Module connector overview

7 Mechanical specifications

This section contains mechanical specifications concerning the U-PRO2S module.

Item	Min	Typical	Max
(A) Top side components	-	31.75mm	32.50mm
(B) PCB	1.50mm	1.60mm	1.70mm
(C) Heat transferring bar	3.95mm	4.00mm	4.05mm
U-PRO2S module weight (inclusive heat transferring bar)		238g	

Table 7-1: U-PRO2S mechanical specifications

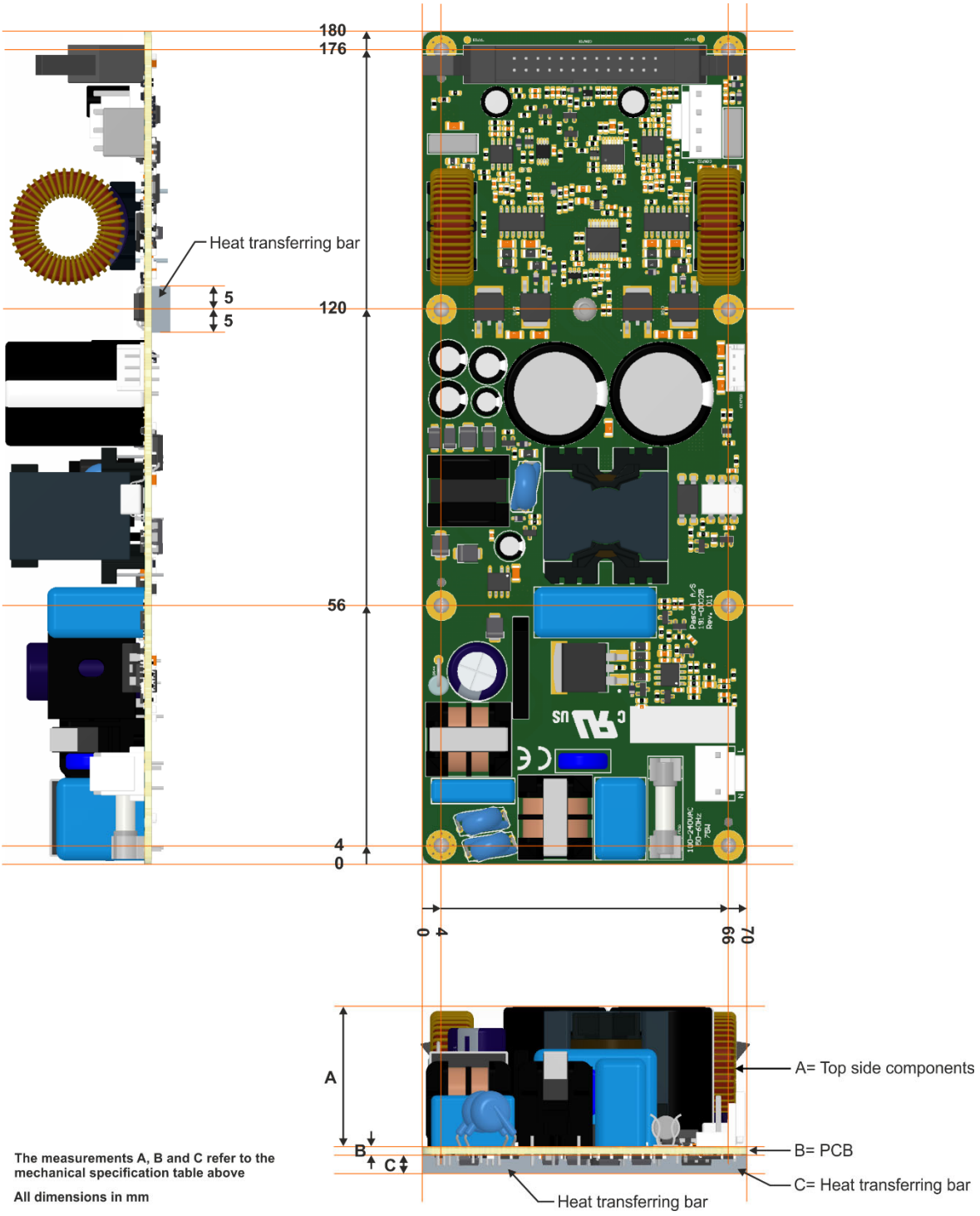

Figure 7-1: Mechanical outline and specifications for the U-PRO2S module

8 Regulatory compliance

8.1 Safety compliance

Safety Standards:
The U-PRO series is safety tested, according to the following standards:

- IEC/EN 60065:2001(7th E) + A1:2005 + A2:2010
- IEC/EN/UL 62368-1:2014 (2nd E)

The U-PRO series fulfills the requirements of:

- EN 60065:2002 + A1:2006 + A11:2008 + A2:2010 + A12:2011
- EN 62368-1:2014
- CSA C22.2 NO. 62368-1-14:2014
- UL 62368:2014

The U-PRO series is evaluated against and complies with the regulations of the following countries:

60065 AR, AT, AU, BE, BY, CA, CH, CN, CZ, DE, DK, ES, EU, FI, FR, GB, GR, HU, IE, IT, JP, KR, MY, NL, NO, NZ, PL, PT, RO, SE, SG, SI, SK, UA, US

62368-1 CA, DK, FI, DE, IE, IT, NO, SE, GB, US, CENELEC common modifications

(Countries outside the CB Scheme membership may also accept the reports.)

Test procedure:

60065 U-PRO CB certificate no. E470499-A6. (UL International Demko A/S)

62368-1 U-PRO CB certificate no. E470499-D1 (UL International Demko A/S)

c UL us UL recognized under file no. E470499

(Full reports are available for download on Pascal Extranet)

Product safety category:
Class II *(Not earthed equipment)*

Special Notice:
The U-PRO series are tested as components – the final product should always be evaluated against applicable standards.

8.2 Electro Magnetic Compliance

Pascal amplifier modules are EMI compliance tested according to the following standards.

Emission:
EN 55032:2012 with EN 55032:2012 AC 2013
EN 61000-3-2:2014
EN 61000-3-3:2013

Immunity:
EN 55103-2:2009

FCC part 15 subpart B

Special Notice:
EMI verification measurements of the final product should be carried out, in order to secure compliance of the final product.

8.3 ESD precautions

In order to retain the right to Pascal warranty on products, precautions on ESD must be taken when handling Pascal products. Handling of Pascal products should comply with the following standards.

IEC 61340-5-2: Protection of electronic devices from electrostatic phenomena. User Guide.
IEC 61340-5-1: Protection of electronic devices from electrostatic phenomena. General.

ANSI/ESD-S20.20: Protection of Electrical and Electronic Parts, Assemblies and Equipment.

8.4 Changes

Pascal Products are continuously undergoing smaller changes to improve the performance or to comply with manufacturing and quality requirements. Therefore, specifications in this data sheet might be subject to change.

8.5 CE marking

See *Declaration of Conformity*, available from www.pascal-audio.com/extranet.

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