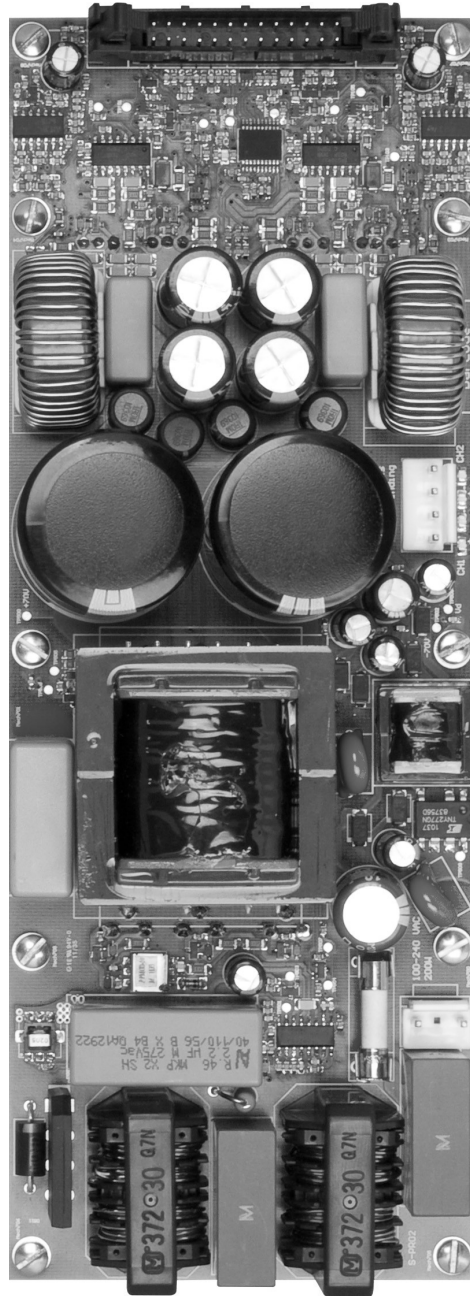


# S-PRO2 Data Sheet



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## Product outline

The S-PRO2 module is a true application dedicated amplifier module for the most demanding professional speaker applications, requiring high-end sonic quality as well as true professional reliability under any conditions.

The S-PRO2 module includes a fully integrated PFC (Power factor correction) regulated power supply and 2 high performance Class D amplification stages.

Key features are outlined below:

- Plug'n'play integrated power package complete with all readout- and protection features for Professional applications, such as subwoofers, high power monitors and line arrays or small speaker systems. The complete integration secures optimal performance and reliability as well as shortened time to market.
- Fully protected high efficiency UREC™ PFC switch mode power supply with universal mains, enabling hassle free worldwide operation.
- Pascal proprietary UMAC™ Class D optimized amplifier power stages, with leading power performance specification and market acknowledged audio specifications.
- Complete interface, including extensive readouts and high auxiliary power for the most advanced DSP solutions.
- EMI and Safety compliant design.

## Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{ACmax}$	Maximum operational off-line voltage	265	$V_{AC}$
$V_{ACmin}$	Minimum operational off-line voltage	85	$V_{AC}$
$f_{AC}$	AC Mains frequency range	45 - 65	Hz
$I_{+15Vmax}$	Maximum +15V current draw	100	mA
$I_{-15Vmax}$	Maximum -15V current draw	-100	mA
$I_{+7.5Vmax}$	Maximum 7.5V current draw	500	mA
$V_{in\_p\_max}$	Maximum peak input voltage, all channels	+/-5	$V_p$
$R_{load\ ch1, ch2}$	Minimum loudspeaker impedance ch1, ch2 (SE-mode)	4	$\Omega$
$R_{load\ ch1, ch2}$	Minimum loudspeaker impedance ch1, ch2 (BTL-mode)	8	$\Omega$
$T_a$	Maximum operating ambient temperature	55	$^{\circ}C$

Table 1: Absolute maximum ratings

## Audio specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{outmax}$	Peak output voltage Ch1, Ch2	Unloaded, SE Unloaded, BTL		70 140		V
$I_{outmax}$	Peak output current			20		A
$P_{o\_tot}$	Total module output power <sup>1</sup> (power supply limited)	230V <sub>AC</sub> 120V <sub>AC</sub>		950 700		W
$P_o$	Output power Ch1, Ch2 @ 1% THD+N 1kHz (AES17 filter), Single ended (SE), single channel driven	$R_L = 4\Omega$ 230V <sub>AC</sub> 120V <sub>AC</sub>		500 500		W
$P_o$	Output power Ch1, Ch2 @ 1% THD+N 1kHz (AES17 filter), Bridge Tied Load (BTL)	$R_L = 8\Omega$ 230V <sub>AC</sub> 120V <sub>AC</sub>		950 700		W
THD+N	THD+N (AES17 filter)	1kHz, 1W, $R_L = 8\Omega$		0.003		%
$V_{noise\ SE}$	Output idle noise Ch1, Ch2 SE	Unweighted A-weighted		65 50		$\mu V_{RMS}$
$V_{noise\ BTL}$	Output idle noise Ch1, Ch2 BTL	Unweighted A-weighted		130 100		$\mu V_{RMS}$
DR <sub>SE</sub>	Dynamic Range Ch1, Ch2 SE	Unweighted A-weighted		117 119		dB
DR <sub>BTL</sub>	Dynamic Range Ch1, Ch2 BTL	Unweighted A-weighted		117 119		dB
Slew rate	Slew rate SE Slew rate BTL			TBD TBD		V/ $\mu s$
$A_{ch1}$	Voltage gain Ch1, Ch2 SE	1kHz		26		dB
$A_{var}$	Frequency response variance Ch1, Ch2 SE	20Hz - 20kHz All loads		+0.0 -0.4		dB
BW <sub>up</sub>	Upper bandwidth Ch1, Ch2 (-3dB), SE	$R_L = 8\Omega$ $R_L = 4\Omega$		70 60		kHz
BW <sub>low</sub>	Lower bandwidth Ch1, Ch2 (-3dB), SE	All loads		1.6		Hz
$Z_o$	Absolute output impedance, Ch1, Ch2 SE	1kHz		6		m $\Omega$
IMD <sub>CCIF</sub>	Intermodulation distortion(CCIF), Ch1, Ch2 SE	18kHz and 19kHz $P_o = 10W, 8\Omega$		0.0015		%
TIM	Transient Intermodulation distortion (TIM), Ch1, Ch2 SE	$P_o = 10W, 8\Omega$		0.0045		%

Note 1: All channels loaded with 4ohm SE or 8 Ohm BTL. Maximum total power is limited by the power supply.

Table 2: Audio specifications

## Input & Output loading

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Z <sub>INPUT</sub>	Input impedance	Ch1(SE), Ch2(SE)		2.2		kΩ
Z <sub>L</sub>	Loudspeaker impedance range	Ch1(SE), Ch2(SE)	4		inf	Ω
Z <sub>L</sub>	Loudspeaker impedance range	Ch1, Ch2 (BTL)	8		inf	Ω

Table 3: Input & Output Loading

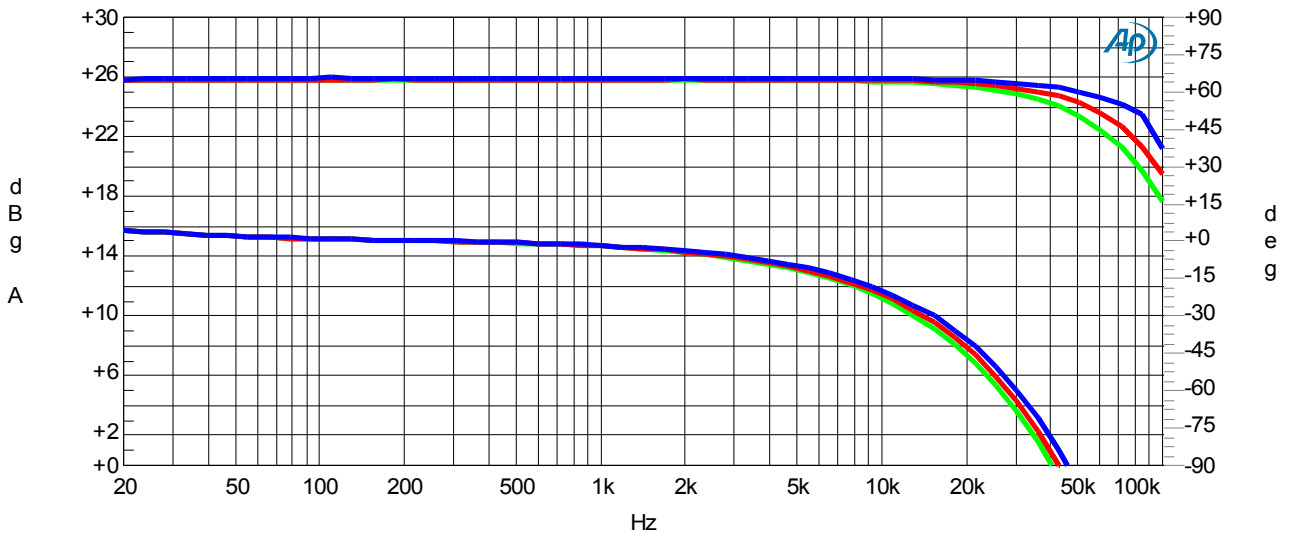
## AC Mains and Thermal specification

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>AC Range</sub>	Operational voltage range		85		265	V <sub>AC</sub>
T <sub>SD</sub>	Temperature @ Thermal shutdown	Thermal hyst.= 10°C		100		°C

Table 4: AC Mains and thermal specification

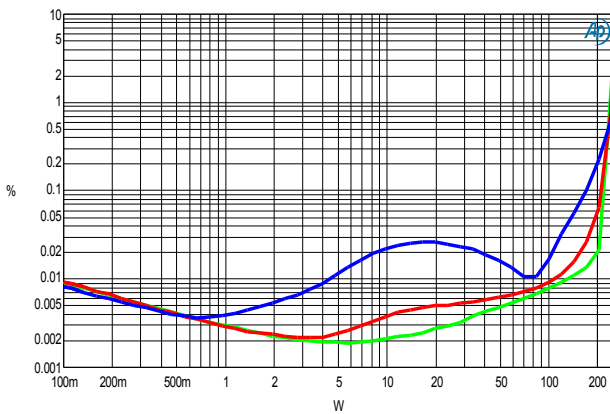
# Audio measurements

## Frequency response

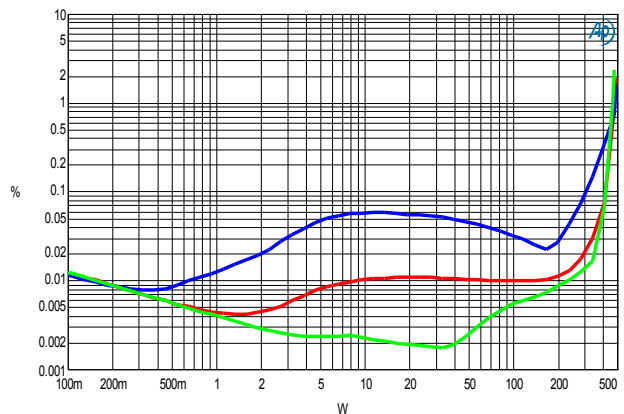


Frequency response, 4Ω(green), 8Ω(red) and open load(blue). Top - amplitude. Bottom - phase.

## Total Harmonic Distortion + Noise

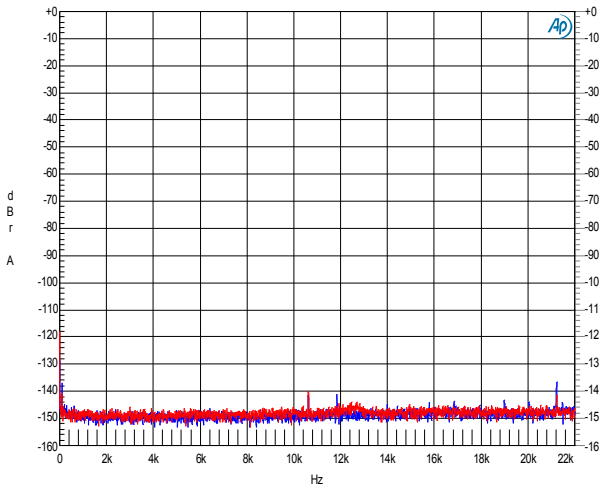


THD+N vs. Po, Channel 1/2, 100Hz(green), 1kHz(red), 6.67kHz(blue), 8Ω

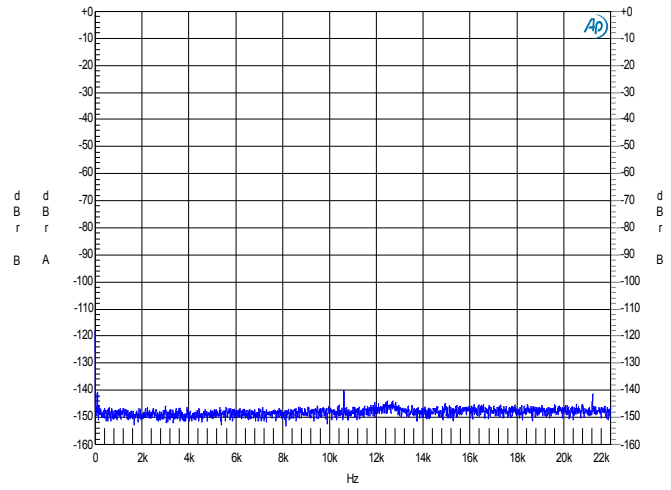


THD+N vs. Po, Channel 1/2, 100Hz(green), 1kHz(red), 6.67kHz(blue), 4Ω

## Noise Spectrum

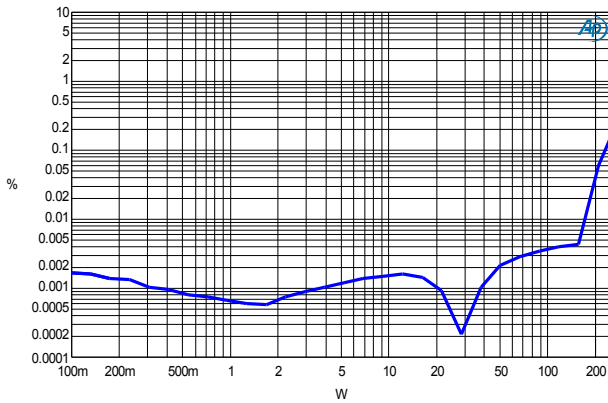


FFT, Channel 1(Blue) & Channel 2(Red), 4 Ohm, SE

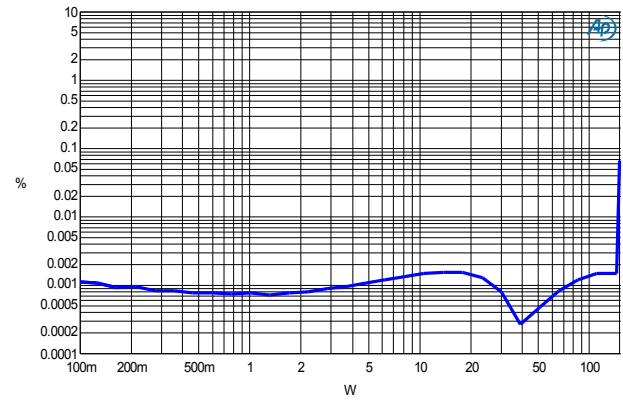


FFT, Channel 1+2, 4 Ohm, BTL

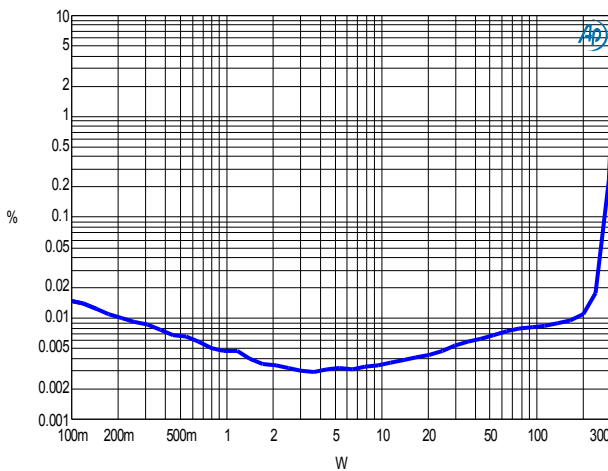
## Intermodulation Distortion (CCIF, TIM)



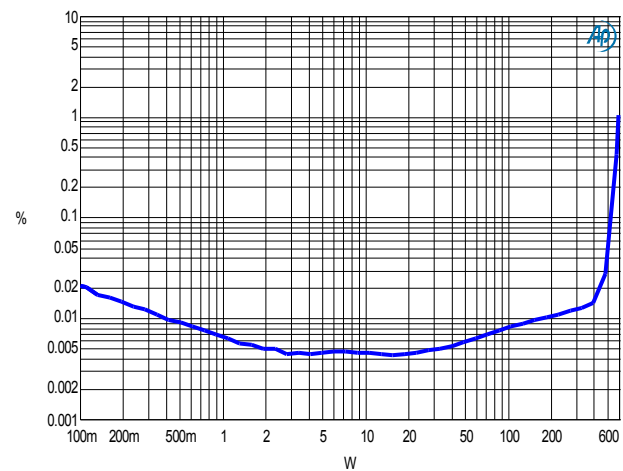
CCIF vs power  $R_L=4$  ohm, channel 1/2,  $f_1=18$ kHz,  $f_2=19$ kHz



CCIF vs power  $R_L=8$  ohm, channel 1/2,  $f_1=18$ kHz,  $f_2=19$ kHz

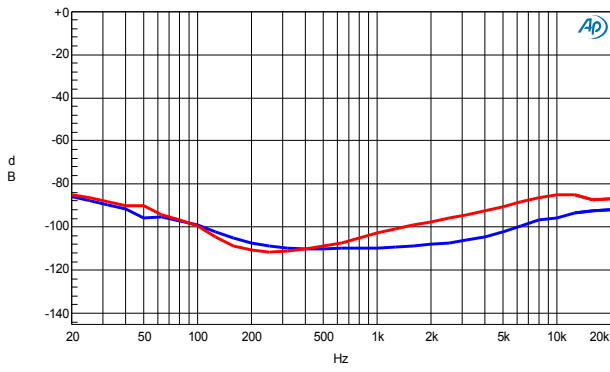


TIM vs. power,  $R_L=8$  Ohm channel 1/2

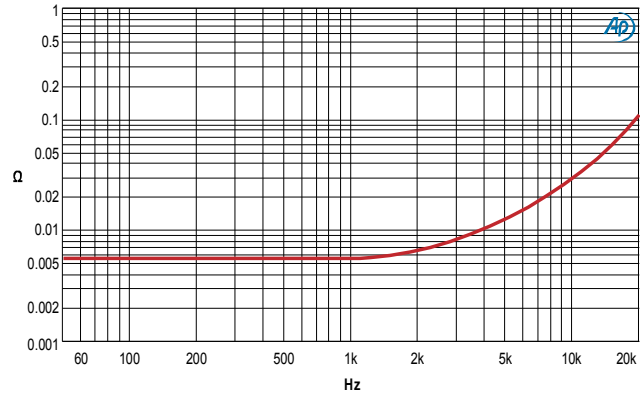


TIM vs. power,  $R_L=4$  Ohm channel 1/2

### Cross Talk & Output impedance



Cross talk: Channel 2,  $P_{o, ch1}=100W$ (Blue),



Output impedance, Channel 1/2,  $I_{out}=1A_{RMS}$ ,

# Product connections

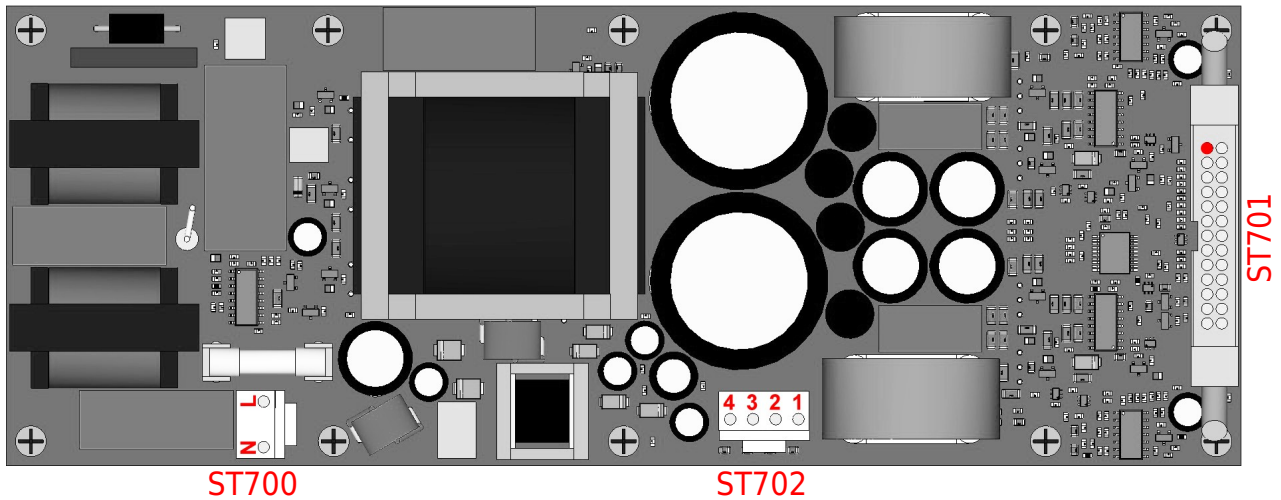


Figure 1: S-PRO2 Connectors

Note: Dotted pin at ST701 in Figure 1 indicates pin 1.

<b>AC Mains (ST700)</b>		
<b>Pin No.</b>	<b>Function</b>	<b>Note</b>
Pin 1	AC Live	AC mains Live input (Shown as "L" on figure 1)
Pin 2	AC Neutral	AC mains Neutral input (Shown as "N" on figure 1)
<b>PCB connector counterpart list:</b>		
PCB connector: JST B2P3-VH		
Cable connector housing part number: JST VHR-3N (Farnell: 630482)		
Cable connector pin part number: JST BVH-21T-P1.1 (Farnell: 630500)		

Table 6: AC Mains (ST700) Connector

<b>Speaker output (ST702)</b>		
<b>Pin No.</b>	<b>Function</b>	<b>Note</b>
Pin 1	Ch2 Signal return	Amplifier channel 2, Out-
Pin 2	+Ch2 <sub>Out</sub>	Amplifier channel 2, Out+
Pin 3	Ch1 Signal return	Amplifier channel 1, Out-
Pin 4	+Ch1 <sub>Out</sub>	Amplifier channel 1, Out+
<b>PCB connector counterpart list:</b>		
PCB connector part number: JST B4P-VH (Farnell: 9492020)		
Cable connector housing part number: JST VHR-4N (Farnell: 630494)		
Cable connector pin part number: JST BVH-21T-P1.1 (Farnell: 630500)		

Table 7: Speaker output (ST702) Connector

<b>Input &amp; Output (ST701)</b>			
<b>Pin No.</b>	<b>Function</b>	<b>Type</b>	<b>Note</b>
Pin 1	Signal return Channel 1	Input (SGND ch1)	Connect to ch1 signal source GND at DSP-board
Pin 2	Signal input channel 1	Input ( $V_{in+}$ ch1)	$3.5V_p$ correspond to full output voltage, 26dB gain
Pin 3	Signal Shield	AGND	Connect to analog GND at DSP-board
Pin 4	Signal return Channel 2	Input (SGND ch2)	Connect to ch2 signal source GND at DSP-board
Pin 5	Signal input channel 2	Input ( $V_{in+}$ ch2)	$3.5V_p$ correspond to full output voltage, 26dB gain
Pin 6	Temp Monitor	Output <sup>2</sup>	0 - $3.3V_p$ correspond to 0 -100 degrees Celcius
Pin 7	V Out monitor channel 1	Output <sup>2</sup>	+/- $10V_p$ correspond to +/- 70V on output
Pin 8	V Out monitor channel 2	Output <sup>2</sup>	
Pin 9	Clip channel 1	Output, Active low	Open collector <sup>1</sup>
Pin 10	Clip channel 2	Output, Active low	
Pin 11	Dis read/Protect	Output, Active low	Indicates amp channels switched off. Open collector <sup>1</sup>
Pin 12	Internal use	Internal	Don't connect
Pin 13	Disable (Mute)	Input, Active Low	Switches all amp channels off.
Pin 14	Internal use	Internal	Don't connect
Pin 15	Internal use	Internal	Don't connect
Pin 16	Sleep mode	Input, Active low	Low power standby
Pin 17	+7.5V	Output	Maximum current $500mA^3$ (available also in sleep mode)
Pin 18	+7.5 V	Output	
Pin 19	GND (ref +7.5 V)	GND	Ground reference for +7.5V supply rail
Pin 20	GND (ref +7.5 V)	GND	
Pin 21	+15 V	Output	Maximum current $100mA^3$ on +15V (available also in sleep mode)
Pin 22	+15 V	Output	
Pin 23	GND (ref +/-15 V)	GND	Ground reference for +/- 15V supply rail
Pin 24	GND (ref +/-15 V)	GND	
Pin 25	-15 V	Output	Maximum current $100mA^3$ on -15V (available also in sleep mode)
Pin 26	-15 V	Output	
<b>PCB connector counterpart list:</b>			
PCB connector housing part number: Greenconn Corporation GPHA220-1302B03			
Cable connector housing part number: Greenconn corporation GPHA220-1302B02A (Farnell:(Multicom alternative) 1099240)			

Table 11: Input & Output (ST701) Connector

Note 1: All open collector outputs have two  $100\Omega$  resistors ( $200\Omega$  in total) in series with the open collector.

Note 2: These are high impedance outputs, which must be buffered or interfaced to e.g a u-processor.

Note 3: Aux. power on each rail is limited by a total Aux. Power of 6W.

## Open Collector Inputs/Outputs

All collector outputs are implemented as shown on the picture below. The 2 pcs of 100Ω resistors are inserted to protect the open collector transistor and the 1nF capacitor has been implemented as EMI filtering.

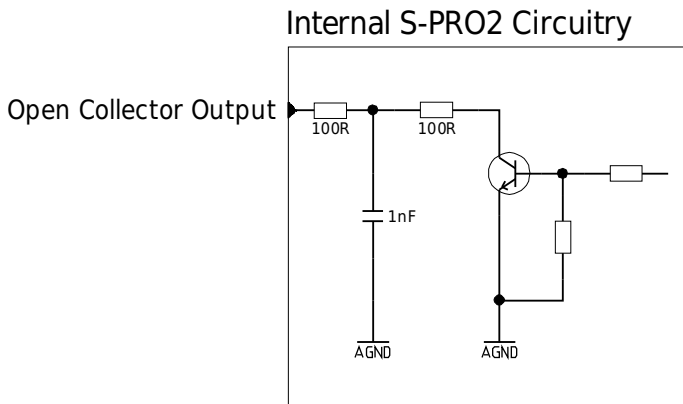
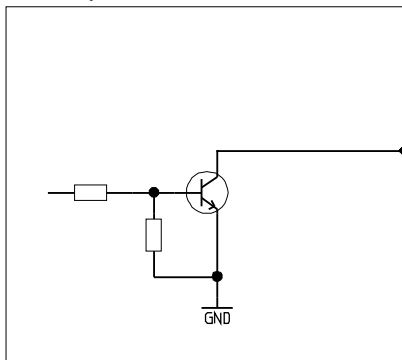


Figure 3.1: Open Collector Output of S-PRO2

For open collector control for the S-PRO2 module please refer to the figure below.

### DSP Open Collector



### Internal S-PRO2 Circuitry

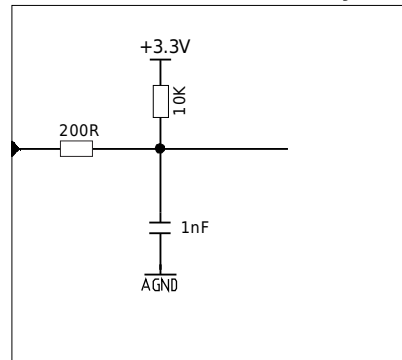
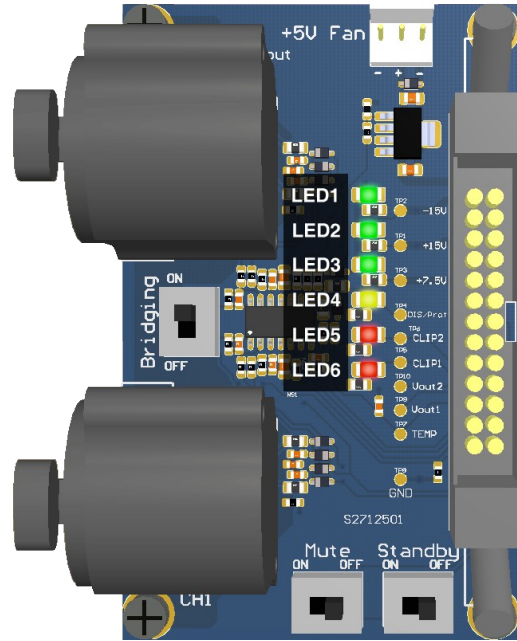


Figure 3.2 Open collector control of S-PRO2 input

## I/O Board LED indicators



### LED Functionality on I/O board

LED No.	Function	Normal Operation	LED Indication	LED Indication Result
LED 1	+15V	ON	ON OFF	+15V present +15V not present
LED 2	-15V	ON	ON OFF	-15V present -15V not present
LED 3	+7.5V	ON	ON OFF	+7.5V present +7.5V not present
LED 4	Disable	OFF	ON OFF	Channel 1+2, Disable (Mute) or protection Channel 1+2, Enabled
LED 5	Clip Limiter <sub>CH2</sub>	OFF	ON OFF	Channel 2, Clip limiting Channel 2, Not clipping
LED 6	Clip Limiter <sub>CH1</sub>	OFF	ON OFF	Channel 1, Clip limiting Channel 1, Not clipping

Table 5: LED Functionality

# Single Ended (SE) & Bridge Tied Load (BTL) configuration

Channel 1 and channel 2 of the S-PRO2 module can be operated in either SE or BTL mode<sup>1</sup>.

## SE input configuration

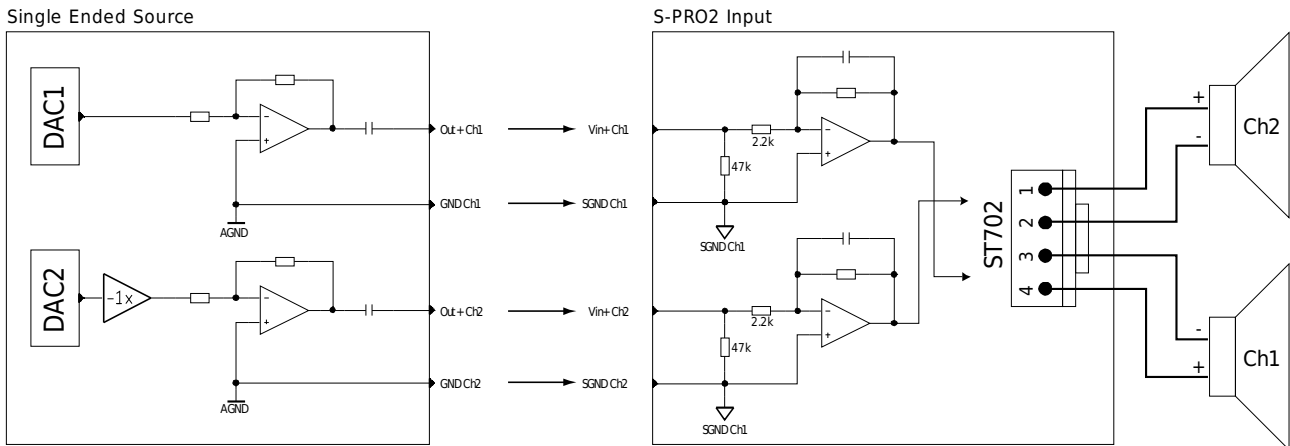


Figure 6: SE input configuration

## BTL input configuration

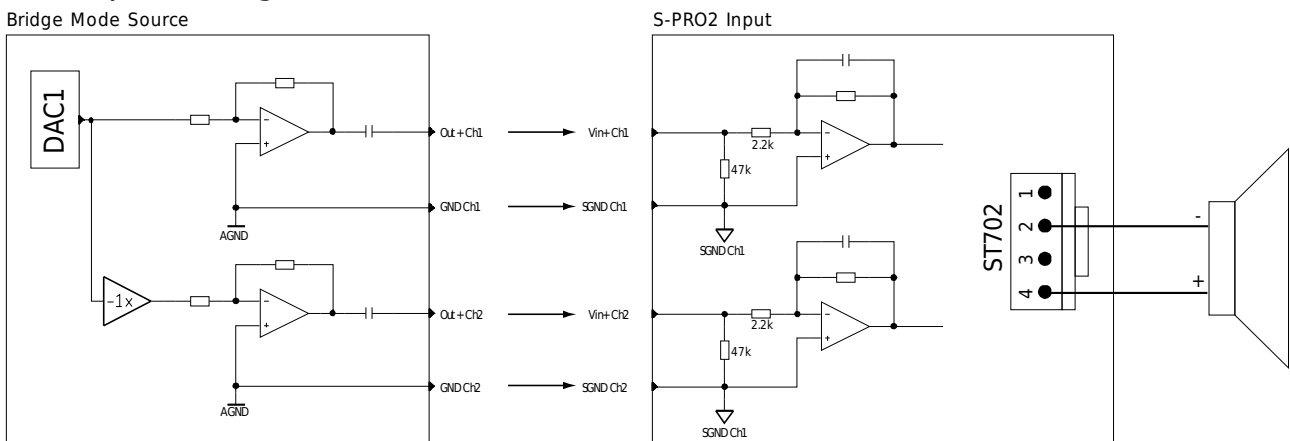


Figure 7: BTL input configuration

Note 1: For amplifier output loading in SE or BTL mode, please refer to Input & Output Loading section.

## Protection features

### Over current protection

All amplifier channels are over current protected on outputs.

Current clipping is engaged when the amplifier channels exceed its specified peak current output. This can be seen as the output voltage of the amplifier being clipped.

If the current output of an amplifier channel exceeds its specified peak current output for a longer period of time e.g in case of a short circuit of the output, the amplifier will be disabled (Muted) for 1000ms and automatically restart.

### DC protection

A built-in DC protection circuit will attenuate any DC signals on the amplifier inputs, produced by an input signal containing a DC signal. In case of a permanent DC on the output of the amplifier, the amplifier will latch and power must be removed for the product to restart.

### Over-/under voltage protection

Power supply over- and undervoltage protection is implemented, which means that the power supply will enter a protection mode when the operational off-line voltage exceeds or drops below the specified upper and lower operational off-line AC voltages. However exceeding  $265V_{AC}$  for a longer period of time might damage the power supply primary side permanently.

### Temperature protection

Temperature protection of powerstages and heatsinks is implemented to secure the amplifier module from overload.

When thermal protection is engaged the amplifiers disables (Mutes) for a period of time and automatically restarts , after the powerstage or heatsink temperature have reached the specified thermal start-up temperature.

### Standby – Energy Star Compliance

This function is designed as a special feature for installation purposes.

When the amplifier is put into Sleep Mode, major circuitry parts are powered down, which leads to low AC mains power input specification of less than 0.5W.

In sleep mode the +7.5V and +/- 15V rails are still active, which enables a possible network/DSP to remotely power up the amplifier again.

### High frequency protection

A high frequency protection is implemented in order to protect filter components from overload.

The high frequency protection algorithm has been implemented to protect the amplifier from excessive HF signals on the the amplifier outputs.

The amplifiers have a full power bandwidth of 20 kHz, which will be allowed for unlimited time, 30kHz full power is allowed for 2 seconds before protection becomes active.

## Readouts

### Clip

When the amplifier output peak voltage or current exceeds the specified values, the amplifier channel will start clipping the Voltage/Current. Clipping indication has been implemented for each amplifier channel. After the clipper is activated a limiter is engaged, resulting a a clip-limitation. Clip limitation indication for channel 1 and 2 can be monitored on ST701, Pin 9 and Pin 10.

### Dis read/Protect

The Dis read/protect indication is based on an open collector output, indicating if any of the amplifier channels or the power supply is in disable (Mute) or in protect mode. This indicates either an external shutdown or an on-board protection condition. Dis Read/Protect can be monitored from ST701 pin 11.

### Temp Monitor

Temperature monitoring is made at several points in the amplifier and power supply. The maximum temperature of any measurement point is provided as the Temp Monitor output, which can be monitored on ST701 pin 6.

### Output voltage

Output voltage is measured on channel 1 and 2 and supplied as a bi-directional sinusoidal voltage output. Output voltage for channel 1 and 2 can be measured on ST701 pin 7 and 8.



## Safety compliance

S-PRO2 modules are safety tested, according to the following standards:

IEC60065: 2001 (7<sup>th</sup> Edition) + A1: 2005  
EN60065: 2002 + A1:2006  
UL60065: 2003, CSA C22.2 60065-03 + Am 1 (2006)

Test procedure: CB  
S-PRO2 CB certificate no. available on request (Pending)

Product safety category: Class 2 (Non-Earthed equipment)

## Electro Magnetic Compliance

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

EN55103-1 Emission

EN55103-2 Immunity

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

## ESD warning

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 to 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 Requirements.  
ANSI/ESD-S20.20-1999: Protection of Electrical and Electronic Parts, Assemblies and Equipment.

## Changes

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

For further information

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