

S-A1/2 Extension Module Datasheet

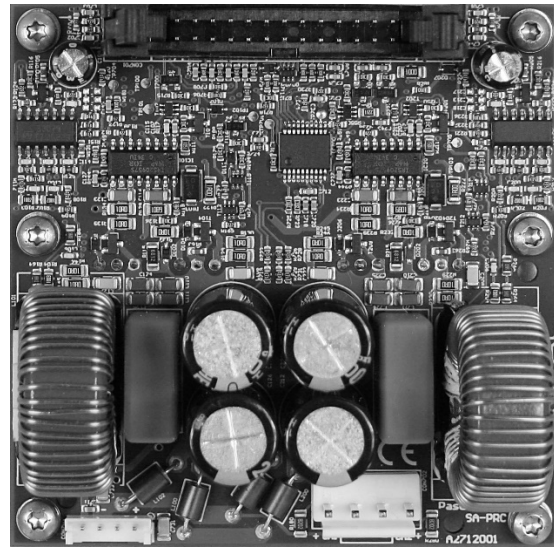
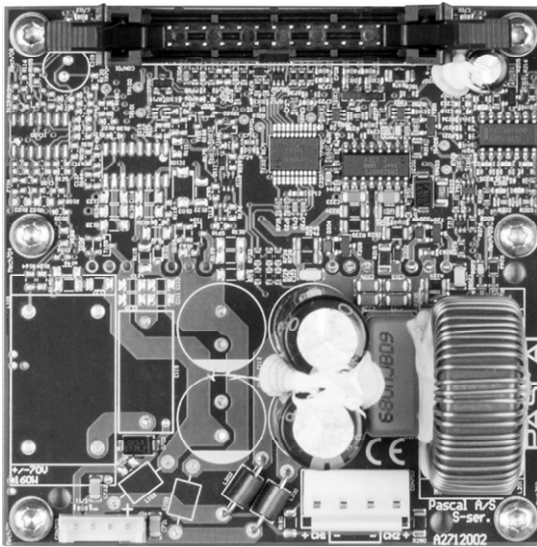


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1 Features and Description

Features

- 500W (SE), 2 x 500W (SE) or 1000W (BTL) amplifier channels using Pascal's UMAC™ technology for un-matched sonic performance and full power bandwidth up to 35kHz
- ErP (1275/2008/EC) compliant standby consumption < 0.5W supplied by the Pascal S-PRO2 module.
- Full protection scheme
- Ultra compact size
- Multiple readouts (temperature, amplifier output voltage, clip limiter, amplifier protect/mute, $V_{AC,peak}$)
- Safety approved and verified for EMC compliance

Description

The S-A1/2 Extension Module is a 1 or 2 channel Class-D amplifier that works as an extension module for the S-PRO2 module. With the S-A1/2 Extension Module, in combination with the S-PRO2 module, it is possible to make a setup with:

- 3 or 4 SE channels
- 1 BTL channel and 1 or 2 SE channels
- 2 BTL channels

In addition the S-A1/2 Extension Module offers a number of readouts and controls, which allow for external DSP control of the module.

Product Summary

Parameter	Typical Value
Output power (1% THD+N, 1kHz @ 4Ω)	1000 W
Peak output current	30 A
THD+N (1kHz @ 1W)	0.003 %
Dynamic range	120 dB(A)
Idle noise	40 μ V(A)
Output impedance (1kHz)	14 mΩ

Typical Applications

- Professional Audio Solutions
- MI Audio Solutions
- Consumer Audio Solutions
- HiFi Audio Solutions
- Self-Powered Loudspeakers
- Installation Systems

2 General specifications

2.1 Audio specifications

Electrical Characteristics @ $T_a = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{out,max}}$	Peak output voltage Ch1 ¹ & Ch2 / Ch1 – Ch2 ²	Unloaded, SE Unloaded, BTL	-	± 70 ± 140	-	V
$I_{\text{out,peak}}$	Peak output current		-	30	-	A
$P_{\text{o,tot}}$	Total module output power ³	230V _{AC} 120V _{AC}	-	1000 700	-	W
P_{o}	Output power @ 1% THD+N, 1kHz ⁴ Ch1 ¹ & Ch2 - Single ended (SE), single channel driven $R_L = 8\Omega$	230V _{AC} 120V _{AC}	-	245 245	-	W
P_{o}	Output power @ 1% THD+N, 1kHz ⁴ Ch1 ¹ & Ch2 - Single ended (SE), single channel driven $R_L = 4\Omega$	230V _{AC} 120V _{AC}	-	490 490	-	W
P_{o}	Output power @ 1% THD+N, 1kHz ⁴ Ch1 ¹ & Ch2 - Single ended (SE), single channel driven $R_L = 2.7\Omega$	230V _{AC} 120V _{AC}	-	725 600	-	W
P_{o}	Output power @ 1% THD+N, 1kHz ⁴ Ch1/Ch2 - Bridge Tied Load (BTL) ² - $R_L = 8\Omega$	230V _{AC} 120V _{AC}	-	900 700	-	W
P_{o}	Output power @ 1% THD+N, 1kHz ⁴ Ch1/Ch2 - Bridge Tied Load (BTL) ² - $R_L = 4\Omega$	230V _{AC} 120V _{AC}	-	1050 700	-	W
THD+N	THD+N @ 1W, 1kHz, $R_L = 8\Omega$ ²	SE BTL	-	0.003	-	%
$V_{\text{noise SE}}$	Output idle noise - Ch1 ¹ & Ch2 – SE	Unweighted A-weighted	-	60 40	-	μVRMS
$V_{\text{noise BTL}}$	Output idle noise - Ch1 - Ch2 – BTL ²	Unweighted A-weighted	-	75 55	-	μVRMS
DR_{SE}	Dynamic Range - Ch1 ¹ & Ch2 – SE	Unweighted A-weighted	-	118 120	-	dB
DR_{BTL}	Dynamic Range - Ch1 - Ch2 – BTL ²	Unweighted A-weighted	-	122 124	-	dB
$V_{\text{noise SE,IO}}$	Output idle noise - Ch1 ¹ & Ch2 SE. Pascal S-PRO2 I/O-board attached.	Unweighted A-weighted	-	70 55	-	μVRMS
$V_{\text{noise BTL,IO}}$	Output idle noise - Ch1 - Ch2 BTL ² . Pascal S-PRO2 I/O-board attached.	Unweighted A-weighted	-	120 95	-	μVRMS
$DR_{\text{SE,IO}}$	Dynamic Range - Ch1 ¹ & Ch2 SE. Pascal S-PRO2 I/O-board attached.	Unweighted A-weighted	-	116 118	-	dB
$DR_{\text{BTL,IO}}$	Dynamic Range - Ch1 - Ch2 BTL ⁴ . Pascal S-PRO2 I/O-board attached.	Unweighted A-weighted	-	118 120	-	dB
A	Voltage gain @ 1kHz, Ch1 ¹ & Ch2 SE / Ch1 – Ch2 BTL ²	SE BTL	-	26 32	-	dB
A_{var}	Frequency response variance Ch1 ¹ & Ch2 SE @ 20Hz – 20kHz	Open Load 8 Ω 4 Ω 2.7 Ω	-	0.15 0.25 0.45 0.65	-	dB
BW_{up}	Upper bandwidth @ -3dB Ch1 ¹ & Ch2 - SE	$R_L = 8\Omega$ $R_L = 4\Omega$	-	70 60	-	kHz
BW_{low}	Lower bandwidth @ -3dB Ch1 ¹ & Ch2 - SE	All loads	-	1.6	-	Hz

Z_o	Absolute output impedance ^{2,5}	SE 1 kHz SE 20 kHz BTL 1 kHz BTL 20 kHz	-	14 175 25 300	-	mΩ
$V_{out,offset}$	Amplifier output DC Offset ²	SE 4Ω BTL 8Ω	-	±0.5 ±1.0	-	mV
IMD _{CCIF}	Intermodulation distortion (CCIF), Ch1 ¹ & Ch2 - SE	18kHz & 19kHz P _o = 10W, 8Ω	-	0.0015	-	%
IMD _{TIM}	Transient Intermodulation distortion (TIM), Ch1 ¹ & Ch2 - SE	P _o = 10W, 8Ω	-	0.0035	-	%

Table 1 Audio Specifications.

Note 1: Ch1 is not available on S-A1

Note 2: BTL Configuration is not applicable for S-A1

Note 3: Maximum total power from all S-PRO2 and S-A1/2 amplifier channels is limited by the S-PRO2 power supply.

Note 4: Measured using the Audio Precision AES-17 filter.

Note 5: Measured 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 ¹	Ch1 & Ch2	-	2.2	-	kΩ
Z _{L,SE}	Loudspeaker impedance range Single Ended (SE) ¹	Ch1 & Ch2	2	4	∞	Ω
Z _{L,BTL}	Loudspeaker impedance range Bridge Tied Load (BTL) ²	Ch1-Ch2 (BTL)	4	8	∞	Ω
Z _{L,C}	Maximal purely capacitive loading of amplifier output	SE BTL ²	-	-	1	μF

Table 2 Input & Output Loading.

Note 1: Ch1 is not available on S-A1

Note 2: BTL Configuration is not applicable for S-A1

2.3 Power consumption & Thermal specification

Electrical Characteristics @ $T_a = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{120\text{VAC NS}}$	Mains power input No signal applied Pascal S-PRO2 I/O-board attached. S-PRO2 + S-A1	Standby Mute Idle	-	0.3 8.9 12.6	-	W_{RMS}
$P_{120\text{VAC NS}}$	Mains power input No signal applied Pascal S-PRO2 I/O-board attached. S-PRO2 + S-A2	Standby Mute Idle	-	0.3 9.8 14.6	-	W_{RMS}
$P_{230\text{VAC NS}}$	Mains power input No signal applied Pascal S-PRO2 I/O-board attached. S-PRO2 + S-A1	Standby Mute Idle	-	0.35 10.7 14.6	-	W_{RMS}
$P_{230\text{VAC NS}}$	Mains power input No signal applied Pascal S-PRO2 I/O-board attached. S-PRO2 + S-A2	Standby Mute Idle	-	0.36 11.6 16.5	-	W_{RMS}
$P_{120\text{VAC NS}}$	Mains power input No signal applied S-PRO2 + S-A1	Standby Mute Idle	-	0.28 6.8 11	-	W_{RMS}
$P_{120\text{VAC NS}}$	Mains power input No signal applied S-PRO2 + S-A2	Standby Mute Idle	-	0.28 7.7 12.9	-	W_{RMS}
$P_{230\text{VAC NS}}$	Mains power input No signal applied S-PRO2 + S-A1	Standby Mute Idle	-	0.32 8.7 13	-	W_{RMS}
$P_{230\text{VAC NS}}$	Mains power input No signal applied S-PRO2 + S-A2	Standby Mute Idle	-	0.33 9.5 14.8	-	W_{RMS}
T_{SD}	Temperature @ thermal shutdown Thermal hysteresis = 5°C		-	85	-	$^\circ\text{C}$

Table 3 AC Mains & Thermal specifications.

2.4 S-PRO2 auxiliary power supply specification

The S-A1/2's small signal circuitry draws power from the S-PRO2 auxiliary supply. This limits the available current draw for external circuitry compared to the available power when using a single S-PRO2.

Electrical Characteristics @ $T_a = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{+7.5\text{V}}$	+7.5V voltage variation	Module ON ¹	7.0	7.5	8.5	V
$V_{+15\text{V}}$	+15V voltage variation	Module ON ¹	14	15	16.5	V
$V_{-15\text{V}}$	-15V voltage variation	Module ON ¹	-16.5	-15	-14	V
$I_{+7.5\text{V}}$	+7.5V current rating		-	-	425	mA
$I_{+15\text{V}}$	+15V current rating		-	-	50	mA
$I_{-15\text{V}}$	-15V current rating		-	-	-50	mA

Table 4 Auxiliary power supply ratings for the S-PRO2 when combined with an S-A2 Extension Module.

Note 1: For more detailed auxiliary power ratings and conditions in standby – see the S-PRO2 and the S-A1/2 Application Manuals

3 Audio measurements

3.1 Frequency response

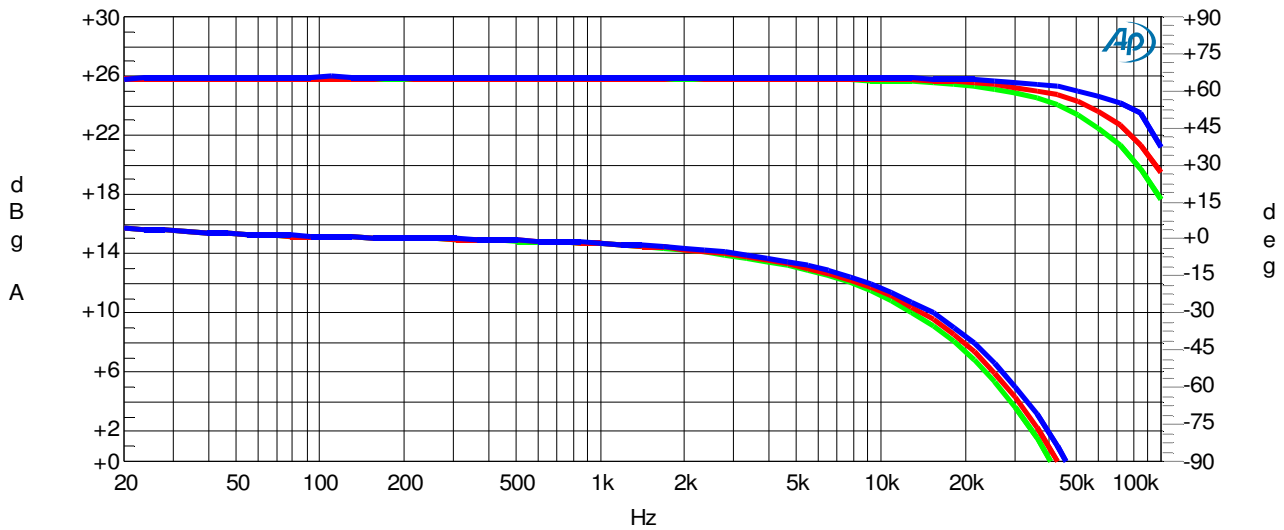


Figure 3-1 Frequency response (Top curves: Amplitude, Bottom curves: Phase)
4Ω (green), 8Ω (red) and Open Load (blue).

3.2 Total Harmonic Distortion + Noise (THD+N)

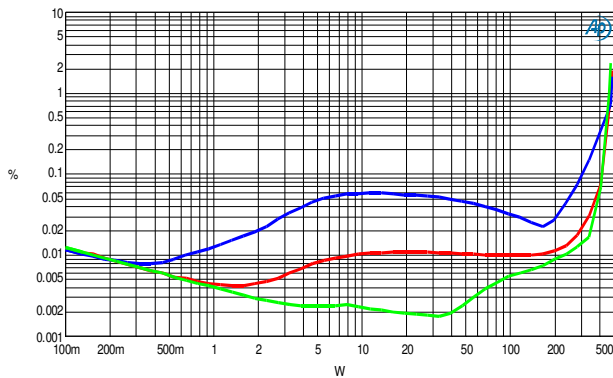


Figure 3-2 THD+N vs. Power @ 4Ω
100Hz (green), 1kHz (red), 6.67kHz (blue).

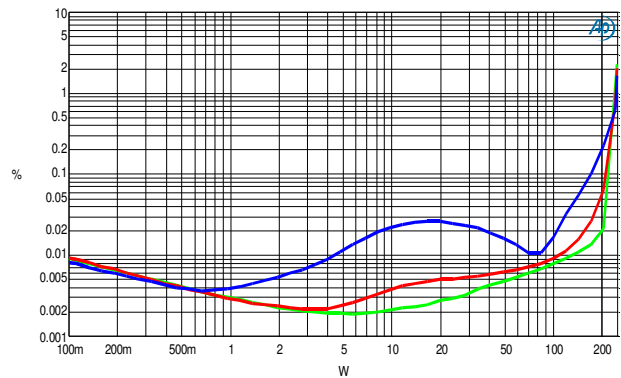


Figure 3-3 THD+N vs. Power @ 8Ω
100Hz (green), 1kHz (red), 6.67kHz (blue).

3.3 Noise Spectrum

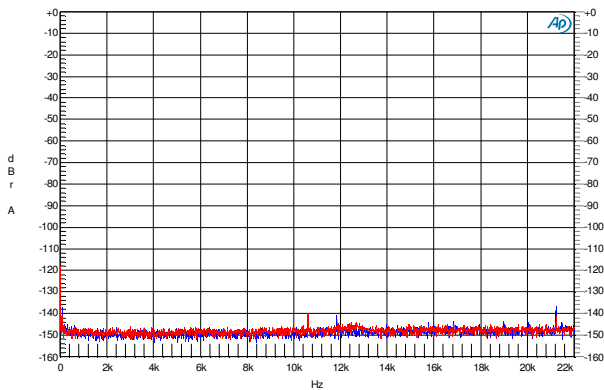


Figure 3-4 FFT idle - 4Ω SE
Channel 1 (blue) & Channel 2 (red).

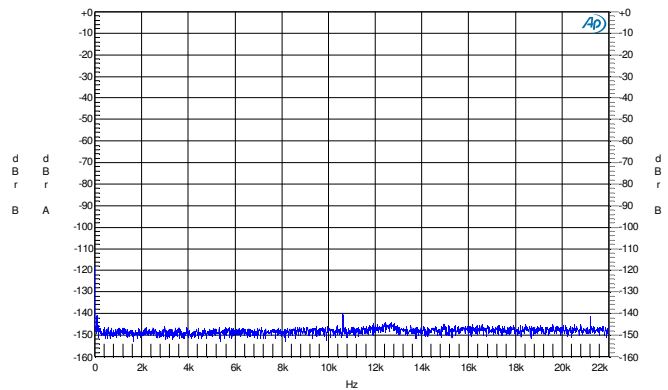


Figure 3-5 FFT idle - 4Ω BTL
Channel 1-2 BTL.

3.4 Intermodulation Distortion (CCIF, TIM)

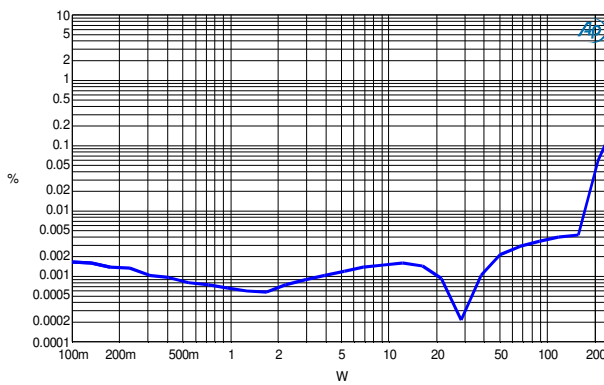


Figure 3-6 CCIF vs. Power - $R_L=4\Omega$
Channel 1/2, $f_1=18\text{kHz}$, $f_2=19\text{kHz}$.

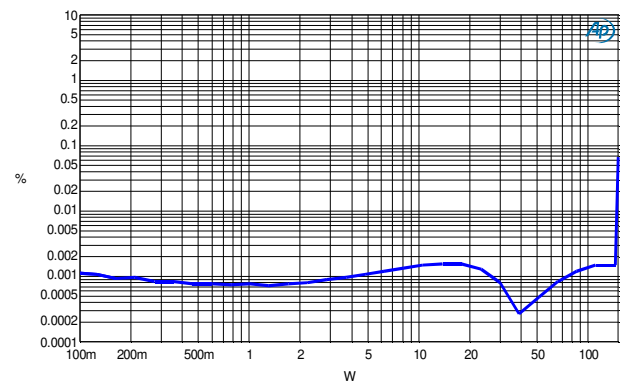


Figure 3-7 CCIF vs. Power - $R_L=8\Omega$
Channel 1/2, $f_1=18\text{kHz}$, $f_2=19\text{kHz}$.

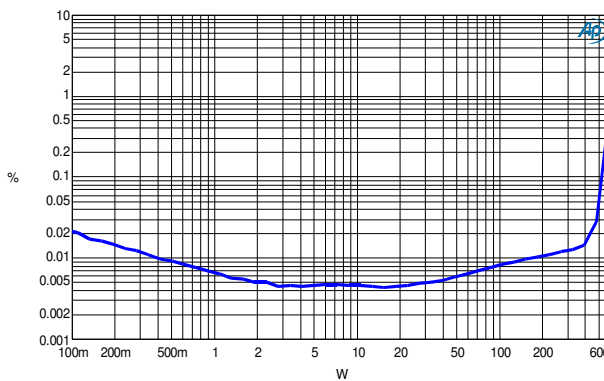


Figure 3-8 TIM vs. Power - $R_L=4\Omega$
Channel 1/2.

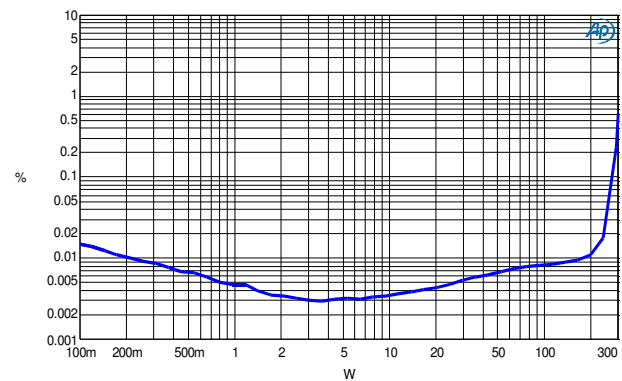


Figure 3-9 TIM vs. Power - $R_L=8\Omega$
Channel 1/2.

3.5 Cross Talk & Output Impedance

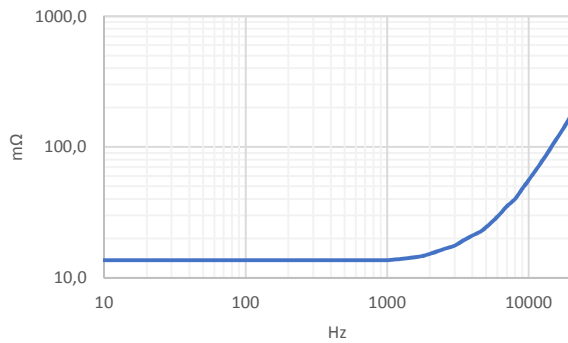


Figure 3-10 Output impedance SE - Measurement made at the mating part of the output connector. Connector resistance thereby included.

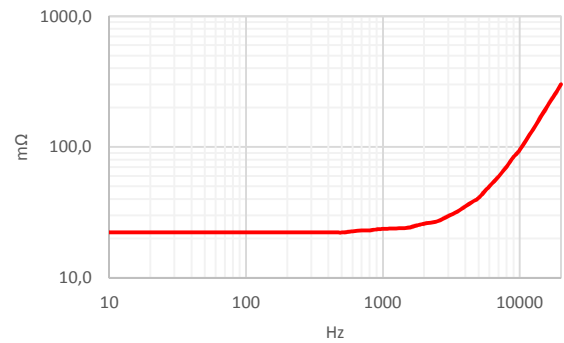


Figure 3-11 Output impedance BTL - Measurement made at the mating part of the output connector. Connector resistance thereby included.

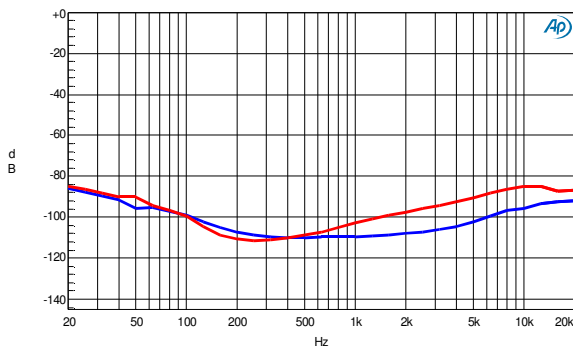


Figure 3-12 Cross talk - Ch.1 @ $P_{o,ch2}=100W$ 4Ω (red), Ch.2 @ $P_{o,ch1}=100W$ 4Ω (blue)

3.6 Output Power vs. Frequency

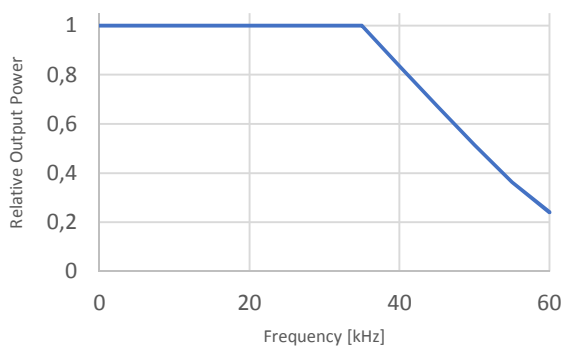


Figure 3-13 Output Power vs. Frequency

4 Control Readouts

4.1 Control pins

The control pins of the S-A1/2 work in conjunction with the S-PRO2 module.

Mute – The S-A1/2 module will be muted through the S-PRO2 module. When muting the S-PRO2 module, the amplifiers outputs will be disabled. It typically takes 2 ms to disable and only 4 ms to enable the amplifiers. The mute function may be used with an external wake-on-music circuitry to lower the mains power consumption when the modules are unused, but still with the modules ready to play in typically 4 ms – making it unnoticeable for the user.

Standby – With the S-A1/2 module and the S-PRO2 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) with a total power consumption of less than 0.5W. This includes a current draw of up to 15 mA on the +7.5V supply for external standby control circuitry.

4Ω BTL Mode – Out-of-the-box the S-A1/2 module is optimized for loads from 4 ohm SE (8 ohm BTL) and up. Still it is possible to use the S-A1/2 module with a 4Ω speaker in BTL operation by setting the S-PRO2 module into “4Ω BTL Mode”.

Note “4Ω BTL Mode” is a global setting selected by connecting the S-PRO2 Pin 14 in Con701 to GND at power up. “4Ω BTL Mode” applies for all S-PRO2 and S-A1/2 amplifier channels if set on the S-PRO2. S-A1/2 Pin 14 in Con701 can’t be used for selecting “4Ω BTL Mode” only for the S-A1/2 module, the pin must be left as a No Connect pin.

4.2 Readouts

The S-A1/2 has various readouts to monitor the state of the module.

- **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.
- **Amplifier Output Voltage readout** – There are two amplifier output voltage readouts - one for each channel. These readouts are voltage divisions of the output signals in the range of ± 10 Vp corresponding to ± 70 Vp at the output. This may be used for signal presence indication.
- **Amplifier Clip readout** – There are two amplifier clip readouts - one for each channel. These readouts are open-collector outputs. The readout pins will be pulled low if the audio output voltage becomes too high, compared to the internal rail voltages, or if the amplifier reaches internal current protection. These readouts may be used for signal clip/limiting indications.
- **Disable/Protect readout** – This readout is an open-collector output which will be pulled low when either the S-PRO2 module or S-A1/2 module is muted or has entered an internal protection.

For further details see the S-PRO2 and S-A1/2 Application Manuals.

5 Protection features

The S-A1/2 has built-in protection features which protect the module and speaker from malfunctioning.

- **Clip limiter** – The clip limiter prevents excessive clipping of the output stage by limiting the input signal.
- **Temperature** – Temperature protection of the module is implemented to prevent thermal runaway. When thermal protection is engaged both amplifier channels are muted until the temperature has dropped 5°C.
- **Over Current** – If an amplifier output is shorted or reaches its current limit, the built-in clip limiter will try to limit the input signal. If the limiter isn't capable of limiting the signal the module will enter over-current protection and mute the outputs until the over-current is no longer present and the internal protection timing allows the module to re-enable.
- **DC Protection** – In case of a DC at one of the outputs the amplifier is first muted. If the DC is still present, after 3 cycles, the S-A1/2 and the connected S-PRO2 are switched off and require a AC re-cycling to reset. For the S-A1/2 DC Protection to function correctly, S-A1/2 control signal "Standby mode/DC protect" must be connected to the S-PRO2 control signal "Standby mode".
- **HF Protection** – A high frequency protection is implemented in order to protect the output filter components from overload above 35 kHz. If a high frequency signal is present for a longer period of time the module will enter HF protection and mute the outputs until the high frequency signal is no longer present and the internal protection timing allows the module to re-enable.

For further details see the S-PRO2 and S-A1/2 Application Manuals.

6 Mechanical specifications

