



S250

250W switching audio power amplifier



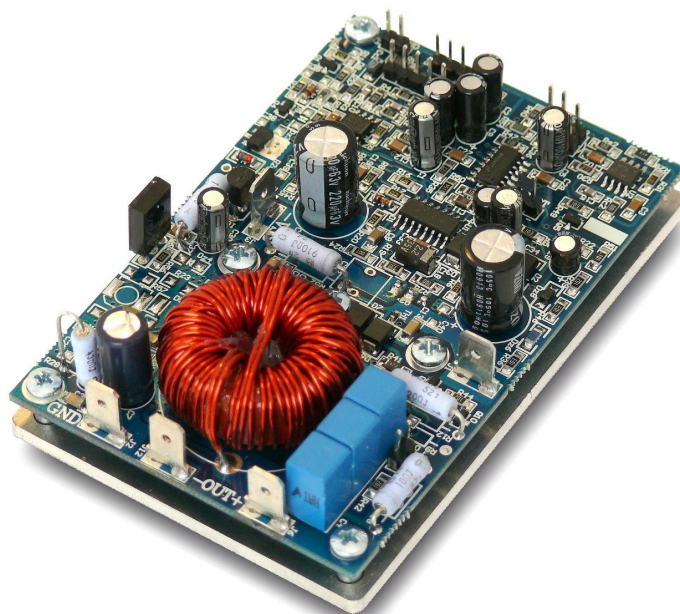
Description

coldamp presents the new **Sonora** series of state of the art Class-D power amplifiers with true high-end performance. **S250** is the smallest product of this series, producing up to 250W rms (4 Ω) full-range power. It is targeted to hi-end hi-fi systems and active speakers, and features very low distortion and high S/N ratio (>103dB) . The design is optimized for utmost sound quality.

Ease of connection: requires a single (symmetrical) supply. **No additional aux. voltages needed!** Our range of SMPS (SPS30, SPS80) is specially adequate to power this module or a set of them.

Extremely low power consumption: only **5W idle power** at nominal rails voltage, **3W in stand-by** mode. Its high efficiency (>90%) allows almost no-heat-sink operation and less wasted power, hence reducing power supply requirements.

The design is based on **Class-D** concept, with synchronous natural-sampling PWM design.



Features

True high-end performance:

- 250W @ 4 Ω , 150W @ 8 Ω , down to 1 Ω capability defined for <0.5% THD+N
- High output current capability (16A peak, with overcurrent protection)
- Gain: 34 dB (40 dB with balanced input), freq. response: 6 Hz to 30 KHz (-3dB), THD: 0.015% at 1W (5 Ω , 100Hz).
- **Global feedback** system for reduced THD and almost load-independent frequency response, even with extremely low impedance loads.
- Silent turn on / turn off.
- Fully synchronous PWM design with clock input/output possibility that eliminates potential interchannel interferences produced in other free oscillating designs.

High efficiency and low idle power:

- >90% efficiency at full power, only **5W** losses (typ) ON with no-signal (idle), and **3W** in stand-by mode

Easy and flexible connection:

- Simple supply requirements: symmetric +/-30 to +/-53V, with fast-on type connectors. No auxiliary supply voltages required.
- Balanced audio input, also featuring potentiometer header for easy volume control connection
- External shutdown input
- Two modules can be bridged for higher power output (>500W/8ohm) without external circuitry

High reliability and many integrated protections and indicators:

- Overcurrent protection (non dissipative), undervoltage lockout (UVLO) and overvoltage shutdown (OV). All errors (except OCP) are latched for 2 secs, with output for LED indicator or external error management. Clipping detector with LED output and PROTECT signalling output

Small size, low weight and easy cooling

- Dimensions: 68x100x26mm – Fits into 1U standard 19" rack enclosures. Weight: 150 g
- Screwing the module to a chassis or aluminium plate provides enough cooling for most applications.

Absolute maximum ratings

Parameter	Min	Typ	Max	Units
Supply voltage (+VCC and -VSS), to GND ⁽¹⁾	30	50	53	V
Output current (peak) ⁽²⁾		16		A
Minimum load impedance	1	4		Ω
Operating temperature	-	-	80	°C

Audio performance (V_{cc} , V_{ss} = +/-50v from SPS30 unless otherwise stated)

Parameter	Typ. Value	Units	Conditions
Output power, 4 ohms	250	W rms	<0.5% THD, 1KHz sine, 4 ohms
Output power, 8 ohms	150	W rms	<0.5% THD, 1KHz sine, 8 ohms
THD (Total Harmonic Distortion)	0.02	%	100Hz, 5 Ω , 1W
SNR (Signal to noise Ratio)	>106	dB	Input shorted, referred to full power with 0.5% THD
Output noise level	250	μ V	(-72dBV rms unweighted)
Bandwidth at -3dB	6-33K	Hz	8 Ω load
Bandwidth at -1.5dB	17-20K	Hz	8 Ω load
Input impedance	10	K Ω	
Output impedance ⁽³⁾	TBD		To be defined
Output ripple (at switching frequency)	350	mVrms	Inputs shorted to GND

Other parameters (V_{cc} , V_{ss} = +/-50v from SPS30 unless otherwise stated)

Parameter	Typ. Value	Units	Comments
Switching frequency	360	KHz	
ON/OFF threshold voltage	2.5	V	Module is deactivated below that
Efficiency (output stage)	>93	%	400W output at 4 ohms
Idle power (ON mode)	5	W	Measured with no input
Standby power (OFF mode)	3	W	
Clipping LED output current	8	mA	
PROTECT mode activated output voltage	12	V	
CLK output amplitude	6	Vpp	Ultralinear triangle wave

NOTES:

- ⁽¹⁾ Below +/-30V, UVLO is activated, above +/-53V, OVP is activated. Both error conditions remain latched for 2.5 secs. Approx.
- ⁽²⁾ Limited by overcurrent protection, that once triggered remains activated for 2.5 seconds approx. The overcurrent threshold has a negative temperature coefficient, so it will get lower if the module is allowed to run too hot.
- ⁽³⁾ Current limiting circuitry is not detrimental for output impedance, as it doesn't use a sense resistor.

Output power

Maximum rated output (250Wrms) can be obtained with 4 ohm load and +/-48V rails. With 8 ohm, the available power is somewhat higher than half of that. Operation at 2 ohm or lower impedance is possible but overcurrent protection will turn the module off when peak current is 16 amperes, thus limiting output to about 250W rms. If required, total available power (and idle power dissipation) can be reduced by lowering the supply rails down to around +/-32V (110W/4ohm or 60W/8ohm).

Connection

The following figure shows the different connections to the Sonora S250 module. Some of them are necessary, and others are optional.

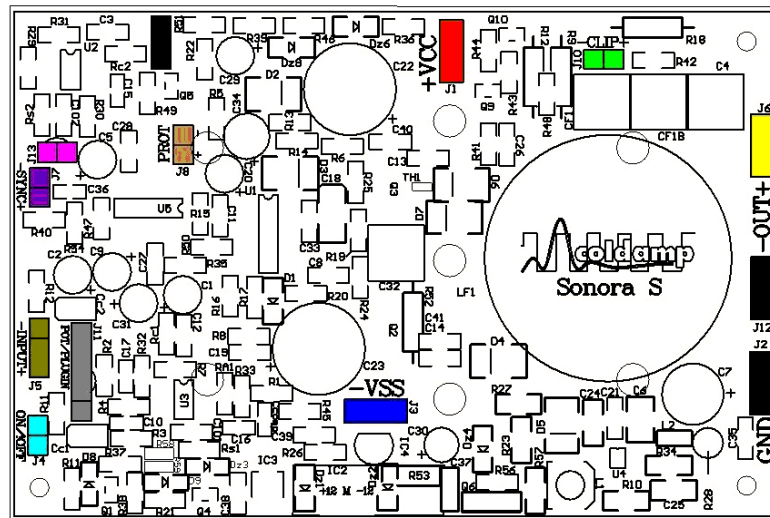


Fig 1: Connections of Sonora S250 module

Power supply:

The module only requires a symmetric (+ and – referred to GND) supply, ranging from +/-30V to +/-53V. Supplies outside this range will activate undervoltage lockout or overvoltage protection, preventing operation of the module (these conditions are indicated in the PROTECT output). The power supply must be connected to three of the FASTONS, as follows:

- +VCC (RED in figure 1), J1: positive +50V nominal
- GND (BLACK in figure 1), J2: ground
- VSS (BLUE in figure 1), J3: negative -50V nominal

coldamp recommends the use of our specially-designed switching power supplies SPS30 or SPS80. This supply allows drastic size reduction of the system, as the bulky toroidal mains transformer is no longer needed, with regulated output that holds voltage tightly even with very demanding loads, while at the same time very low noise is still attainable.

Alternatively, the supply can be built with a centre-tapped toroidal power transformer (use a 35+35 VAC transformer, 200VA per module for full power utilization), followed by a suitable full-wave bridge rectifier and big filter caps (use at least 10.000uF per rail per module).

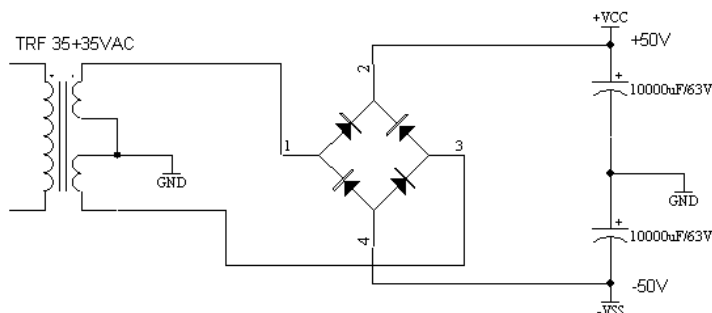


Fig.2: Example of linear +/-50V power supply arrangement for Sonora S250

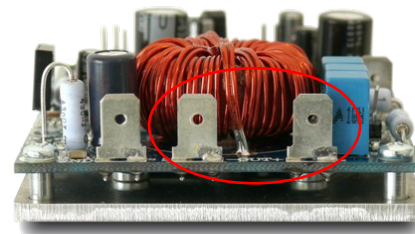
Use thick (1.5mm² approx) wires to connect the +VCC, -VSS and GND inputs to the power supply capacitors, as these wires carry heavy currents. If possible, twist the three wires together.

Speaker:

The module has speaker output and return fast-on connectors. Use thick wires here (around 1.5mm²), preferably twisted together from the module to the speaker posts. For bridge mode connection, see "Sonora S250 Application Notes". The module doesn't require a minimum load for proper operation.

According to figure 1, the speaker must be connected in the fastons:

OUT+ (**YELLOW**, yellow), J6: Speaker (+)
OUT- (**BLACK**), J12: Speaker (-) (internally connected to GND)



Input:

The module has balanced input. This kind of connection (extensively used in professional equipment), allows the connection of direct and out of phase input signals. If a regular (single ended) source, as a CD output, etc, is used, run the three wires (+, - and GND, assigned to pins 3, 1 and 2, respectively) to the input connector, then connect - and GND together at the input connector. This technique produces the cancellation of all the common mode noise picked up by the wires from the connector to the module input.

According to figure 1, the input connector is J5, drawn in **BROWN**. Pin 1 is the top one.

J5 pin	function
1	- input (cold)
2	GND
3	+ input (hot)

IMPORTANT: Use good quality microphone cable (shielded twisted pair, using the pair for +/- inputs and the shield for GND). Run the input wires as short as possible and away from the speaker and supply wires, as any noise produced by the high currents in them will interfere with the source signal, causing distortion. This is a common wiring recommendation for power amplifiers of any class.

Volume potentiometer (optional)

For ease of connection, a single ended potentiometer header is provided after the balanced input preamplifier. This connection should be as short as possible to avoid noise pick-up. Pin 4 is GND, going to the lower potentiometer pin, pin 3 is potentiometer wiper and pin 2 should be connected to the upper potentiometer extreme.



IMPORTANT: If volume potentiometer is not connected (i.e, volume is controlled externally by the source), a jumper must be placed between pins 2 and 3 of that header.

According to figure 1, the input connector is J11, drawn **GREY**. Pin 1 is the bottom one.

J11 pin	function
1	+6V (RFU)
2	Signal from balanced input amplifier
3	Signal to power stage
4	GND
5	-6V (RFU)

NOTE: Pins 1 and 5 (+/-6V supplied by the module) are reserved for future use (i.e., active processing of the signal such as filters, etc.) Don't connect anything to these pins.

ON/OFF control (optional)

coldamp Sonora S250 module features an external shutdown control that allows disconnection of the module by an external switch for all modules in the system or a system controller that reacts to a remote control, switch, overtemperature controller, etc.

Shorting this input to GND disables the amplifier, assessing PROTECT output. Any open collector gate, relay or switch can be used to control the operation of the amplifier. Leaving the input open turns the module on.

According to figure 1, the input connector is J4, drawn in **LIGHT BLUE**. Pin 1 is the top one.

J4 pin	function
1	GND
2	ON/OFF input

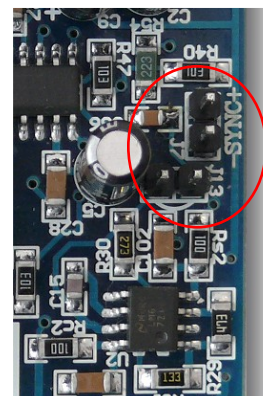
Synchronisation input/output (optional)

With switching amplifiers, under certain circumstances, if several modules are put together in close proximity, the slight differences between each module frequency can lead to audible noises or “whistles”. Unlike other modules, each **coldamp** module has an onboard clock oscillator that controls the switching frequency of the modulator, so this can be corrected very easily by synchronizing the frequency of operation of the modules to one of the modules, known as the “master”. The rest of them will be the “slaves”.

Jumper J13 (drawn **PINK**), shown in figure 1, enables the internal oscillator. **Leave this jumper placed when a module performs as the (one and only) master or when each module runs independently**, i.e., no synchronization is required.

Header J7 is the SYNC in/out. When a module is master, as determined by the presence of J13, this header acts as an output. A shielded cable, as short as possible, must be used to connect to another slave module(s). Pin 1 is the bottom one in fig.1

J7 pin	function
1	Sync I/O
2	GND



IMPORTANT: For normal operation, use independent clocks (SYNC signals unconnected) and place a jumper between pins 1 and 2 of J13 at each module, unless you experience whistles, as distortion may increase due to degradation of the clock along the connections, and supply transient requirements are more demanding.

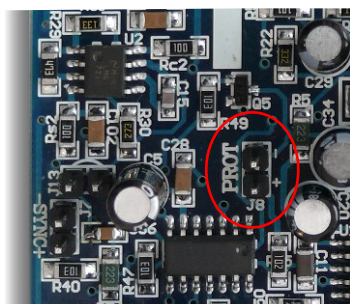
Protection input/output (optional)

This signal provides a mean of knowing when the amplifier module is entering a “protect” or shutdown mode. This can be very useful to connect a LED diode that indicates the condition (**use a 1K5 resistor in series**), or to connect several modules together so when one of the modules enters protect mode, all the modules do the same. This is particularly useful when connecting modules in bridge mode: if for any reason one of the modules protects itself, there will be a large error signal in the speaker due to one of its leads being left floating by the inoperative module. Connecting the PROTECT signals together guarantees that both modules shut down at the same time.

The PROTECT output is assessed when any of the following conditions is present: module OFF due to external shutdown input, overvoltage (OVP), undervoltage (UVLO), overtemperature (OTP) and turn-ON delay. The overcurrent condition (OCP) is not signalled in the PROTECT output.

The PROTECT signal is available in header J8, drawn **BROWN** in figure 1. Pin 1 is the top one.

J8 pin	function
1	PROTECT
2	+6V



NOTE: in case that you want to join the PROTECT signals of several modules, connect only pins number 1 of each J8 header.

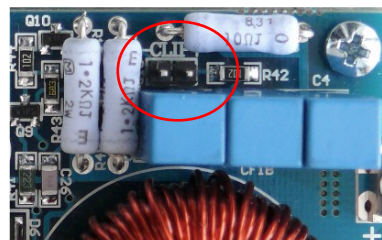
A LED diode can be connected in this header (anode to pin 2 with a 560ohm series resistor).

Clipping indicator LED output (optional)

The module has an onboard clipping detection circuit that can activate an external LED (that can be connected directly, as a current limiting resistor is integrated in the board) whenever the output reaches a value within 2-3V to the supply voltage.

Note that the supply voltage is not the nominal voltage, but the real voltage fed to the amplifier, so when the supplies are low due to high load and/or not enough supply filter capacitance, real clipping is detected.

Clipping indicator feature is very useful for interactive adjustment of the input level by the user, and avoid amplifier saturation, that increases dissipation and can damage speakers.



The CLIP signal is available in header J10, drawn **GREEN** in figure 1. Pin 1 is the left one.

J10 pin	function
1	CLIP LED- (K)
2	CLIP LED+ (A)

Cooling

coldamp high efficiency modules make cooling an easy task. It is **thermally designed for music only**, and the module chassis itself will be enough for moderate power levels, but to get the most from the amplifier, screw it to a chassis to provide all the necessary heatsinking. The Sonora S250 module has four M3-threaded holes at the bottom that can be used to fix it to the chassis from its bottom. (see mechanical drawings at the end of this data-sheet)

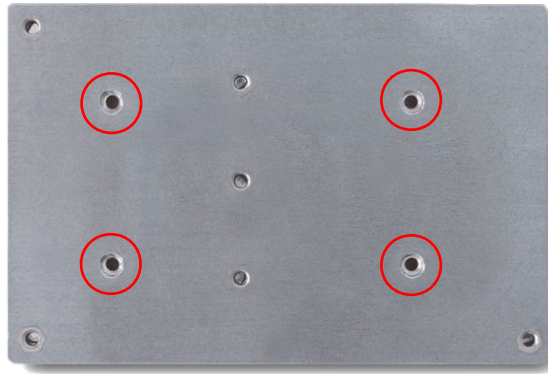
Ensure that both mating surfaces are very clean and use a small quantity of well spread thermal compound to improve thermal transfer.

Note that a very small amount of heat (up to 5W at +/-50V supplies) is generated even when no signal is present. When several modules are enclosed in the same case, it is important that the case is well-ventilated by means, for example, of slits at the top, as in any other electronic equipment (any entirely closed chassis will heat-up with any small power loss to unacceptable temperatures, potentially resulting in long-term module failure). Forced cooling is sometimes recommended, anyway. A very small fan, even not running at full speed (hence producing very little noise) will be enough.

You may also want to implement some way to turn the modules off (stand-by) when they are not used, using the external ON/OFF input (J4). This way the power consumption of the module decreases to around 3W.

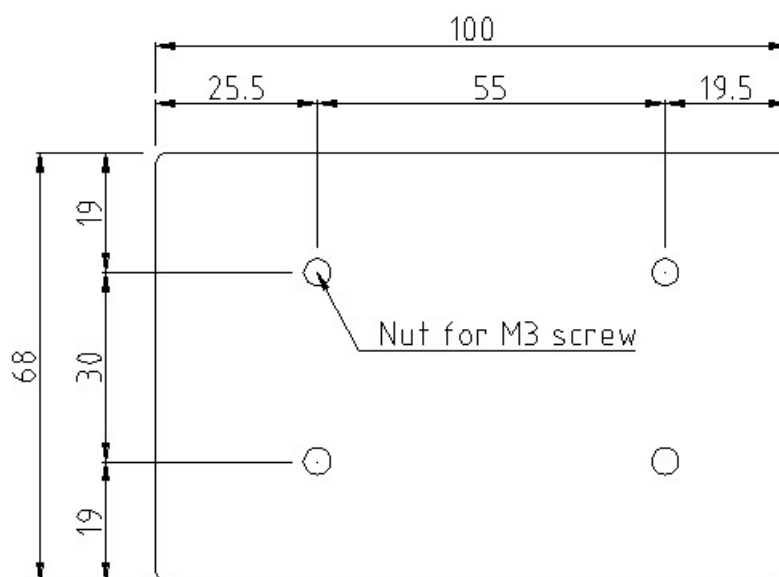
Assembly of the module

For typical applications, we recommend that the module is fixed to the enclosure bottom plate, that should be made of unpainted (although it can be anodized) aluminium (at least 2mm thickness is recommended). In that case, use the 4 threaded M3 inserts in the module to screw it from the case bottom. Use screws with a maximum length of 6mm plus the thickness of the chassis base. Make sure that both surfaces are clean and flat and if possible use a thin and uniform layer of thermal compound.



Sonora S250 base plate (left is output section)

Chassis mechanical drawing (top view)



(All dimensions are in mm. Left is input section)

Important: all the screws used to fix the module from the bottom plate must be M3 metric, max. 6mm plus the thickness of the mounting chassis.

Document History:

Revision A (22 Dic '09)
Datasheet created

Revision B (15 Jan '10)
Some illustrations added