The Micromega MyAMP

A serious design challenge

Following the successful launch of the MyDAC, MyZIC and MyGROOV, the Micromega engineers had a serious design challenge: to complete the MY range by adding a very “modern" integrated amplifier. This of course needed to be fitted with all the latest features and inputs necessary to get the best performance quality possible out of both analog and digital sources.

However, to fit the compact My range size format, the MyAMP had to share the floorplan of the other My products and therefore only the *height* could be different to the other My range models. Equally important, part of the design brief was that the MyAMP needed to be able to drive a large variety of speakers of different sizes and sensitivities, to deliver sufficient power into 8 ohms *and* double this power into 4 ohms. During the design and testing stages, an output power of 30W into 8 ohms and 60W into 4 ohms emerged as a logical choice, given the sensitivity of today’s loudspeakers. This power range delivers a very comfortable listening level in most conditions and allows for the full dynamics of the music to shine through.

For power amplification, the choice was made to utilize a class AB amplifier (rather than class D) simply because of the superior sound quality that Micromega engineers were able to achieve in this design.

Considering its diminutive size, the MyAMP features 3 analog line inputs, two digital coaxial and optical SPDIF inputs, a USB input *and* a Bluetooth aptX © module. A SUB output and a Record output complement the features of this innovative integrated amplifier. In addition, a trigger input allows MyAMP to be turned on and off remotely, and on the same rear connector, an RC5 input can be connected to a home

automation system to enable control of the MyAMP by sending it RC5 remote control codes.

All of these features and benefits are cleverly fitted into a compact 140mm x 140mm x 70mm box.

Choices

The Power supply technical story

The MyAMP uses an ‘’LLC’’ * resonant power supply at the heart of the unit and allows for several advantages over other types of power supplies.

1. Size and weight: The MyAMP power supply delivers 200 W continuous and 260 W peak power (which using a traditional supply would have meant a minimum of a 250 VA toroidal transformer with over 15 000 uF filter capacitors after rectification). This would already be larger on its own that the whole MyAMP and four times the weight. The complete MyAMP weighs only 800g – whereas a 250 VA toroid weighs 3kg on its own.

2) The efficient LLC (Inductance-Inductance-Capacitance) power supply, unlike series resonant LC supplies, is regulated using variable frequency drive over the whole operating range from no load to maximum load, where the MOSFETS are working in soft switching operation mode. These components switch at zero voltage with quasi-sinusoidal current waveforms over the entire control range – and provide smooth current transitions from leading to mains input without EMC and powered electronics problems. This variable frequency drive does not create fix rays (spread spectrum).

3) The control operates on both electrical rails simultaneously via tracking regulation where both rails follow each other perfectly (which is impossible with a traditional supply). This is a very significant advantage to avoid common mode voltages at the input stage of the amplifier.

4) The transient response of the LLC power supply is excellent, with very low

dynamic impedance. The MyAMP power supply switching frequency operating range works from 70 to 100 kHz, (more than two times higher than the audio spectrum) which gives the amplifier a very good dynamic range without masking important fine details in the audio signal.

5) It is not necessary to use large energy reservoir filter capacitors because the capacitors in the MyAMP are charged 20 to 100 times faster than demand - hence the lack of "ripple" even at full load, and avoiding the sagging effect at high inrush current.

6) Finally, the MyAMP power supply features very good efficiency (around 95% at full load) with a low standby consumption well below 1 W, and unlike other resonance power supply types, the MyAMP power supply provides optimum control both at no load and full load.

Amplification class

The choice of a class AB over class D amplification was made for several reasons, despite the larger dimensions, increased power consumption and therefore the greater heat dissipation of Class AB:

1. Unlike class AB, Class D power supply rejection is very low (or nonexistent). It is therefore almost inevitable to pick up RF switching noise that creates Intermodulation Distortion. This is not as good in a class D amplifier as it is in a well-designed class AB amplifier.

2. In a Class D amplifier design it is necessary to use an output filter to smooth the signal. Unless complex circuits and a dual feedback loop are used, the PWM output filter is never suitable for all different types of loads. If it is optimized for 8 ohms, it will not be as good for 4 ohm loads, (or even worse on complex loads like speaker drivers in an enclosure.)

3. The bandwidth of a Class D amplifier is less extended and therefore phase shifts earlier in the audio band than a Class AB amp.

4. Finally, in Class D mode it is not possible to eliminate harmonic distortion (THD) of

odd orders (harmonics 3 and 5) which are inherent between the switching phases of power devices. This often creates a harder sound reproduction and is one of the reasons some people prefer the sound of Class AB amplifiers over Class D. (Having said that, the power to weight ratio and efficiency of Class D does make it very well suited to sound reinforcement or to power big subwoofers.)

The structure that is used for the MyAMP uses a forced-convection heat sink to maintain the compact footprint of the box, while ensuring adequate cooling of the power modules. A thermal protection circuit combined with limiting the supply current guarantees reliable operation, regardless of the operating conditions and the ambient temperature in the room.
The clever design of the extrusion cooling 'tunnel' featuring a very large surface area for cooling, and the choice of a magnetic levitation type fan (without bearings) both ensure an extremely low noise level, of around 12,8 dB (A) at full speed (which is totally inaudible at normal listening distance of 3 to 4 m.) With an air flow of 5.5 CFM at nominal speed, in normal operation the MyAMP fan rotates at a lower speed (about half of the nominal speed) to further minimize the noise of the air flow.

Analog section and volume control

The MyAMP analog inputs are switched through signal relays and then buffered by a FET buffer stage featuring a 1MΩ input impedance. This unique implementation ensures a very low interaction with the sources connected to the amplifier inputs - and reduces by a large amount the influence of the interconnect cables used with the amplifier. The stereo signal is then routed to the volume control circuit and then to the power stages (whose inputs are again buffered by a FET stage with an identical impedance), to reduce considerably the importance of the wired connection between the input card and the main power board.

The MyAMP volume control features a very low distortion resistive 256 step control

of 0.5 dB per step for a very fine adjustment of the volume level. The volume control circuit is followed by a very low noise current-to-voltage converter circuit whose distortion is at the limit of even being measurable. The input card power supply comes through low noise voltage regulators from the main power supply which has very low intrinsic noise and already very efficient regulation. The audio signal thus keeps its integrity in terms of dynamic range and transparency.

A SUB output, resulting from the mixing of left and right line level outputs filtered to 400Hz, -3dB (to ensure a high signal to noise ratio) is used to connect an active subwoofer to MyAMP.

The MyAMP also features a direct record outlet located just before the volume control which gives the user the possibility to record the analog signal after switching.

A headphone amplifier (with a front panel outlet and independent volume) is also included on the MyAMP to complete the feature set on this very up to date and comprehensive integrated amplifier.

The Digital section

The MyAMP digital inputs, SPDIF coaxial and optical, USB and Bluetooth are all processed in SPDIF mode. The coaxial input is isolated by a transformer to avoid ground loops with the source. The USB section is electrically isolated through an ultra-fast bidirectional isolator to avoid interaction with the computer that is connected to MyAMP. The digital section has only one 12MHz clock for all inputs and thus avoids interaction between clocks of different frequencies. The SPDIF receiver that decodes the digital signal does not have a PLL as most receivers of this type but uses a DDS which ensures a very low output jitter of 50ps - guaranteeing the highest quality digital signal. The D/A converter used in the MyAMP is a 24 bit ESS Sabre DAC - recognized as one of the finest D/A converters. Like the MyAMP’s analog section, the attention to detail of the digital engineering provides maximum dynamic range

and exceptional signal-to-noise ratio, guaranteeing a vivid and detailed sound with great clarity.

Conclusion

Despite its very compact physical size, The MyAMP is a BIG amplifier in terms of performance.

All of its features, ease of use and especially its exceptional sound quality make it the ideal partner for many different loudspeakers at the heart of a compact, economical yet extremely high performance hi-fi system. For enthusiasts seeking to improve their system performance further, the MyDAC, MyZIC and MyGROOV make great additions to the MyAMP.

---

*__LLC:__ Technically speaking, an LLC resonant power supply uses a transformer that is designed to have high leakage inductance due to loose coupling power by construction. The magnetizing inductance and leakage inductance cause firstly a parallel resonance (Lm) with the tuning capacitor and a series resonance (Lf). In the range between these resonances, the overall inductive impedance has a slope and a Q factor that depends on the load. The control loop works between the two resonances (and beyond the series resonance at no load) and is always in the presence of an inductive impedance at the primary, and with a zero voltage switching of the switching devices and a secondary triangular current (beyond series Fr) or quasi-sinusoidal (series between Fr and Fr para). Unlike other resonance power supply types, this kind of power supply provides optimum control both at no load and full load.