



# Spartan 30 Headphone / Line Preamplifier By Michael Fidler Reviewed

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When Michael Fidler told me of his plans to build a £450 headphone amp / line stage with a strictly analogue front end, my responses were variations of “you’re mad”. There are already too many desktop headphone amps on the market, most of which can double as a rudimentary preamp to drive external amplification or active speakers, and few of them come with essential modern conveniences like a remote control. God knows the world doesn’t need another. Or does it?

After all, the audio industry hardly needs another exotic cable, amplifier powered by glorified lightbulbs or fake / senseless system ‘enhancement’ – but ‘designers’ of such atrocities seem to come out of the woodwork on an almost daily basis. I’ve been publicly accused by at least 2 manufacturers (Origin Live and Avondale Audio) of calumniating either their products or products of their ilk in these here posts, so in an effort to keep the attention on the product at hand I shall save my vituperative mocking of the audio industry for another day.



<https://i0.wp.com/www.audioappraisal.com/wp-content/uploads/2024/02/Front-view-tilted.jpg?ssl=1>

The challenge Michael faces with his latest product, the Spartan 30, aren't just the overcrowded landscape of similar devices. His immediate hurdle is that the vast majority of those devices are produced by Chinese manufacturers who, through sheer scale of production, use of surface-mount technology and – let's be honest – a more relaxed adherence to component tolerance, are able to knock out similar devices for half the money or less, yet with admirable performance on an audio analyser. The Spartan 30 needs to bring a blend of clever circuit design and some serious spec to the table if it is to compete.

Things get off to a good start with the chunky, heavyweight casework typical of Fidler's designs. The enclosure comprises a pair of aluminium extrusions with integral support slots to house the internal circuit board, a laser-etched aluminium rear panel, and a 6 mm thick etched front panel with neatly bevelled edges and a pleasing symmetry to the positions of the three controls.

On the front are a power switch and a quarter inch headphone jack, facilitating single-ended headphone connection. I've yet to successfully

convince Michael of the sonic merits of a balanced headphone output, but rest assured dear reader, I'm working on it.

The volume knob in the centre controls both the headphone and line outputs and fronts a special analogue potentiometer, more on which later. Michael went to a lot of trouble to get the 'feel' of the volume control just right. My prototype sample had a felt pad behind the pot to increase its tactile resistance, giving it a somewhat scratchy feel. I preferred the looser but smoother and quieter rotation with the pad removed. Some manufacturers fill the pot shaft busing with a thick grease, but that can present issues if the component generates heat which causes the grease to run and usually contaminate the electrical contacts of the pot. Production S30 units use an increased torque potentiometer spec for a smooth feel. From that paragraph alone it is obvious how much attention to detail goes into these products.

On the right is a centre-off (essentially three-position) toggle switch to select between the three single-ended RCA inputs. Most desktop headphone amps have only one input, so this is a welcome addition. The signals themselves are switched by the highest quality Panasonic signal relays at the rear of the board, rated for telecoms use and millions of cycles and mounted as close as possible to the input jacks to keep signal paths as short as possible. There are no input LEDs, but the position of the toggle switch and neat printing makes the chosen input quite obvious.



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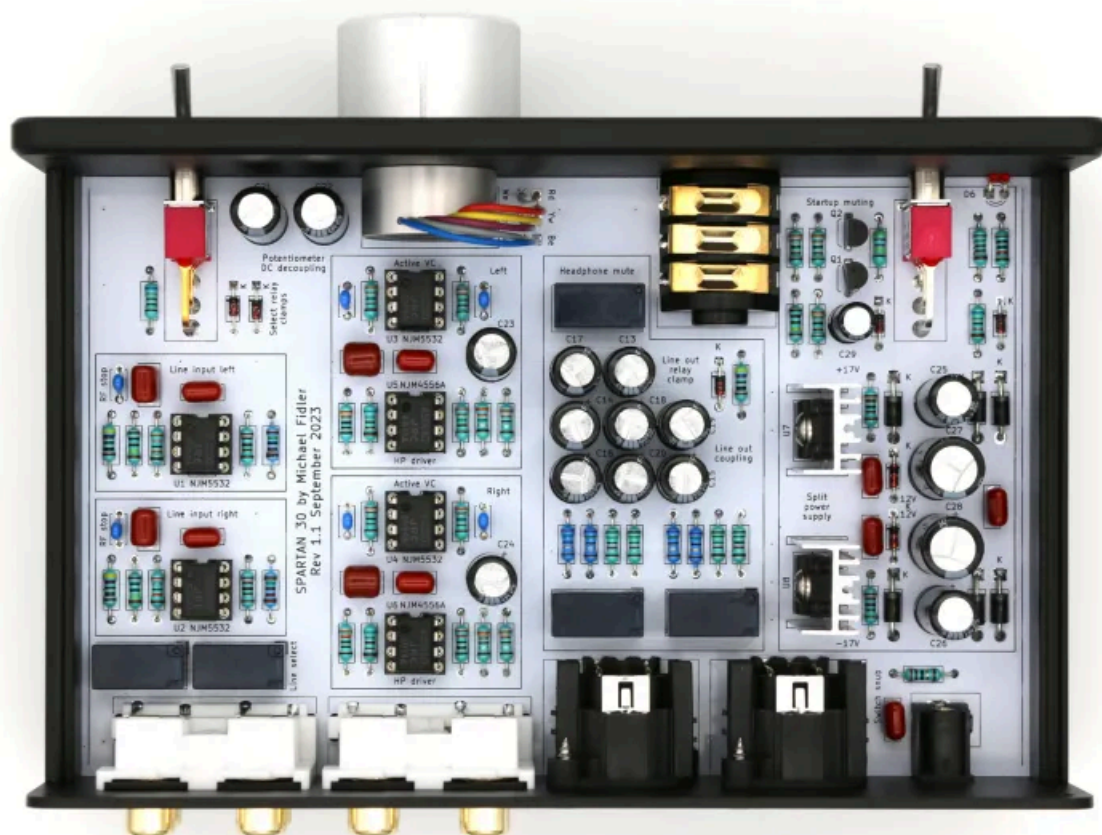
Around back are those three inputs, and a line output in single-ended RCA form. It is accompanied by a fully balanced line output on a pair of XLR connectors and a 5.5mm barrel jack for the included 9V AC 'wall wart' transformer. The preamp draws 0.2W when switched off, with no more than 6W at full rated output, and the linear transformer provided is overrated for the application so is more than adequate. Wall wart transformers have an unfounded reputation in audio circles as being inferior devices, when in fact the opposite is true.

Oh sure, some of the cheap nasty switch-mode units supplied by some manufacturers (I'm looking at you, Pro-Ject, Ifi and WiiM) deserve the hate, but there is nothing wrong with a good switch-mode power supply and certainly nothing to criticise about a well-made linear one. An SMPS is fine for a single-ended connection if it has a local ground – the double insulated ones aren't amazing as the 'suppression' current doesn't have a drain to mains ground (the earth pin where present is usually plastic) and involves a significant suppression capacitor between the 'hot' side and 'cold' side, which some cheaper SMPS units skimp on or omit altogether for cost saving.

The external power supply has several advantages, not least of which the ease of replacement if external factors such as a lightning strike should take out

the transformer. It also helps keep noise and electro-magnetic interference away from the sensitive preamp circuitry. This is more important in phono preamplifiers where the gain in the circuit can be as much as 4000x, but there's a fair amount of gain in a line stage too and the less noise you have, the better.

Under the hood we find yet another beautiful PCB layout, proof that good PCB aesthetics don't mean compromising performance or vice versa. On the right is the input stage, in the middle the 'active balanced volume control, amplification circuitry and output stage, and on the left a robust  $\pm 17V$  power supply intended to keep non-linear amplifier power currents out of the reference ground where they might add distortion. It is constructed using through-hole components, with socketed op-amps, quality connectors and switches made specifically to spec and each rated for a minimum of 50,000 cycles.



<https://i0.wp.com/www.audioappraisal.com/wp-content/uploads/2024/02/Top-open.jpg?ssl=1>

Most products these days are built almost exclusively using SMT (surface-mount technology) which allows for smaller components with shorter signal paths on multi-layer, double-sided boards. Michael's intent was to push traditional through-hole technology to its limits. The Spartan 30 is therefore representative of the best technical performance achievable with through-hole components. With that in mind it is extremely impressive, as its performance is far beyond that of many SMT designs. When it was in its infancy, SMT was once loathed by audiophiles who felt it was the start of the audio industry adopting the general attitude towards a throwaway society, and somehow that the components weren't "audiophile-grade" (a nonsense term however you look at it) or comparable to the traditional through-hole equivalents.

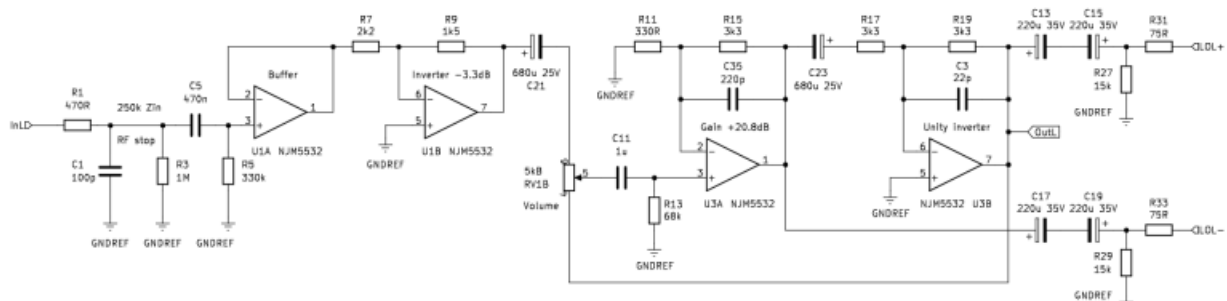
That is still the case with some members of the 'old-boys club' who refuse to get with the times. For the rest of us it means better performance and (in theory) more cost-effective products as component costs are lower, assembly is easier and cheaper, components can be smaller, printed circuit boards can be highly condensed and so on. Future products Michael builds will use surface-mount technology for better performance, but there is no doubting that the Spartan 30, and indeed the Pro-series phono stages, are proof that through-hole components and layouts can still achieve state of the art specs on the test bench

Key to the Spartan 30 is the 'active balanced' volume control. In this circuit, the volume control stage provides all of the voltage gain in the amplifier. The voltage gain can be varied anywhere from 17.5dB to -86dB (unbalanced out) or 23.5dB to -80dB (balanced out).

Ideally, control of the volume stage should follow a logarithmic curve, as this best matches the way we hear. A simple logarithmic potentiometer works to a degree, but these potentiometers are not truly logarithmic at all and instead approximate a logarithmic function by using two linear track resistances of differing slopes.

Named after the late Peter Baxandall, the Baxandall volume control consists of a linear-taper potentiometer, a unity gain buffer with high input-impedance and an inverting amplifier stage that realises the open gain and drives the tail end of the potentiometer that would otherwise be connected to ground in a passive control. Michael's circuit implements the gain in the first stage instead of being just a buffer. This means that the following inverting stage that drives the bottom half of the potentiometer is a unity inverter. Hence the output is inherently balanced from the inverter and first stage as the levels are the same, and the gain being brought up quickly in the first stage means that only the noise contribution of the first stage is relevant as the signal is boosted by about 10 times before it reaches the inverter. In short, an inherently balanced, quiet logarithmic volume control.

An inherently balanced output avoids the noise of an extra differential stage to make a balanced output as well as the drive current which could otherwise be put to decreasing feedback resistor values, with their noise contribution. The Baxandall circuit, not only has to effect some 20dB of gain in the inverter, but also drive the bottom end of the potentiometer with the gain stage. You get a logarithmic approximation (without any discontinuity of a supposedly logarithmic pot where the resistive sections sharply transition from one gradient to another), as the circuit has a squaring function of the potentiometer position once its negative feedback starts to dominate the system.



<https://i0.wp.com/www.audioappraisal.com/wp-content/uploads/2024/02/Main-path.png?ssl=1>

Line-level signal path schematic. From left to right: RF stop network, line input decoupling and high impedance input buffer, first inverter stage, linear volume control potentiometer, first gain stage +20.8dB followed by unity inverter, line output decoupling.

An active control also means that the volume control doesn't have to attenuate and amplify, so has better noise performance, and also the negative feedback reduces distortion even further at lower gains compared to passive controls. As there's no need to attenuate and amplify, there's no gain switch needed to trade the noise floor off against input sensitivity.

The active volume circuit is controlled by a good old-fashioned pot, for which Michael went to considerable effort to track down a suitable part. All the conventional devices tested in during the design process failed to meet the channel tracking and lifespan requirements. A custom part, rated for 5 million cycles and initially intended for industrial applications, was commissioned. Pots are selected by hand for channel tracking within 0.3dB down to -20dB, 0.5dB down to -30dB, and 1dB down to -40dB when implemented in the design.

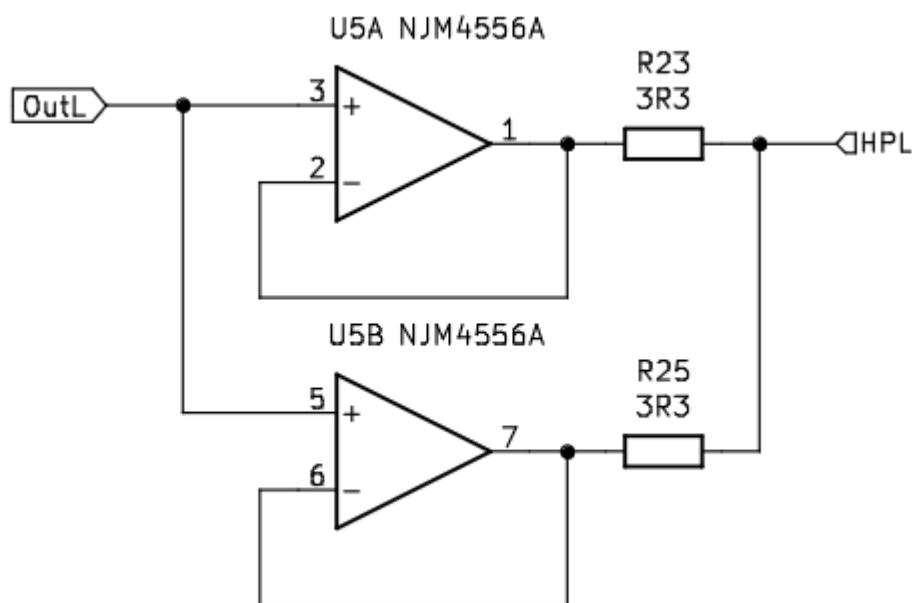
The Spartan 30 uses NJM5532 op-amps mounted in sockets for easy replacement should one fail (unlikely) or be fried by a component upstream. One should resist the temptation to engage in 'op-amp rolling' as the devices used are specifically chosen for the application and are already the optimal components for the job. These are used for the line input and volume control stages, giving a dynamic range of over 128dB with less than 5 parts per million (0.0005%) distortion at 0dB gain.

The S30 can exceed its rated 21V RMS output via balanced (XLR) and 10.5V RMS (RCA) unbalanced outputs. It can also tolerate a full 10.5V maximum input with a bandwidth of 10Hz to 40kHz, making overload with even the hottest source signals highly unlikely. Most single-ended line-level input sources can muster up 2V RMS with a few fractionally higher (usually 2.2V or so) but many much less, conventionally 1V, 0.8V or 0.5V. The only sources that come to mind capable of outputting 10.5V RMS from a single-ended output are Michael's own [Spartan 5 < https://www.audioappraisal.com/classic-audio-spartan-5-phono-stage-reviewed/>](https://www.audioappraisal.com/classic-audio-spartan-5-phono-stage-reviewed/), [Spartan 10 < https://www.audioappraisal.com/spartan-10-by-michael-fidler-retrospective-review/>](https://www.audioappraisal.com/spartan-10-by-michael-fidler-retrospective-review/), Spartan 15, the new Spartan 20 and the [MM <](#)



<https://www.audioappraisal.com/mm-pro-by-michael-fidler-phono-stage-reviewed/> and MC < <https://www.audioappraisal.com/classic-audio-mc-pro-moving-coil-phono-stage-reviewed/> Pro.

The headphone output, designed to work best with the most critical high-impedance types, uses purpose-designed NJM4556 high-current op-amps. Separate ICs for each channel working in parallel pairs halve the effective noise power of each amplifier section and allow for for 160mW, 720mW, 360mW, and 180mW into 32, 150, 300, and 600 ohm loads respectively per channel with less than 0.002% distortion. They operate as unity gain buffers and maintain maximum feedback to keep distortion below 0.001% at a hefty 500mW output into 150Ω from from 20Hz to 22kHz. At the full 720mW into a 150Ω load, distortion is still less than 0.002%. Into a 32Ω load, peak (30 milliseconds give or take) power of over 1W can be achieved before thermal limiting kicks in.



<https://i0.wp.com/www.audioappraisal.com/wp-content/uploads/2024/02/Headphone-driver.png?ssl=1>

The 4556s could be found in headphone outputs for a lot of the excellent Japanese stuff in the 1990s. Usually they were operated with about 10dB of gain, and their own separate volume control pot (as in CD and cassette players from Technics, Sony, Philips, Marantz, Pioneer and many others). These

implementations didn't give amazing distortion figures. They really need to have unity gain to work at their best, as in the S30. They're also relatively slow, about 3V/uS, which gives you a maximum of 35kHz at 10V RMS, 100kHz at 3V RMS etc. which is quite helpful for headphone driving as it makes them very stable, even with relatively low value output resistors (3.3 ohms per side in the case of the Spartan 30).

Headphone output impedance is an innocuous 2Ω. Therefore damping factor is 16, 75, 150 and 300 into 32, 150, 300 and 600Ω respectively. Single-ended line output impedance is 75Ω and naturally 150Ω balanced with a 1KΩ (single-ended) and 2KΩ (balanced) minimum load and a high 220kΩ input impedance for minimal insertion loss with modern and vintage equipment alike.

I tested the Spartan 30 first with my Hypex Nilai 500s set to the medium (21.75dB) gain setting. I encountered my first issue here. When the S30 came out of mute, the tiny pop as the relay contacts closed triggered the clipping detection. The solution as it turned out was to reduce the gain of the Hypex amps to the low (11.86dB) setting, which was necessary anyway as at medium gain only the first 20th of the volume control could be used before the levels were enough to be earsplitting.

This is something to keep in mind if you are using a power amplifier that doesn't have a gain control. I imagine that most S30s will find their way into systems with active monitors (which nearly all have gain controls) are used solely as desktop headphone amps, and in such cases this will not be an issue. It won't play nicely with the vast majority of consumer hi-fi power amplifiers on the market, at least running from the balance output, as most of them have a fixed gain somewhere around 19 to 30dB. Pro audio amps almost universally have adjustable gain and some of them are surprisingly linear and thus great for hi-fi, as you get a lot of power for not a lot of money.

To that end I also used the S30 with a pair of [RCF Ayra 5s](https://www.audioappraisal.com/rcf-ayra-5-review/) < <https://www.audioappraisal.com/rcf-ayra-5-review/>> , Kali Audio LP6 V2s < <https://www.audioappraisal.com/kali-audio-lp6-active-monitors->

[reviewed/>](https://www.audioappraisal.com/kali-audio-in-8-v2-coincident-active-studio-monitors-reviewed/) and [Kali Audio IN-8s < https://www.audioappraisal.com/kali-audio-in-8-v2-coincident-active-studio-monitors-reviewed/>](https://www.audioappraisal.com/kali-audio-in-8-v2-coincident-active-studio-monitors-reviewed/) . And for the majority of the last month I've had it on my desk as a day-to-day headphone amp fed by a MacBook Pro both via its line output and the outputs of an Audient EVO 8 interface.

Like all of Michael's products, it's hard to put words to the sound of the Spartan 30 since all it does it take an input signal, buffer it with increased or reduced gain and drive the connected amplifier or the headphones as cleanly as possible. That is a simplification, but it is in reality perfect summation of the Spartan 30. The first thing I noticed was the low noise. There is a tiny bit of noticeable hiss with sensitive 32Ω headphones, but you have to strain your ears to hear it. My Topping A90D is audibly silent, but it's an extra £150 and is a radically different design to the Spartan.

Music is delivered with complete clarity across the full spectrum and beyond. There's an absence of harmonic distortion that renders the natural timbre of notes and the harmonics of instrument and vocal resonance intact, delivered with scrupulous attention to detail.

There's plenty of power too. It can't match the massive 3.35W that my reference Topping A90D can push into a 32Ω load via its single-ended outputs, but it has plenty of headroom to drive all but the most inefficient headphones to levels high enough to damage your hearing with regular exposure. This is important as it means that at normal listening levels you will be operating well within the amplifier's headroom, and distortion and noise will both be negligible.

It's not far off the Topping's 250mW into a 600Ω load however, and using the 600Ω variant of the Beyer DT880 and DT990 the two are broadly similar in performance, such much so that I doubt I could tell them apart in a blind A/B comparison. The Topping gets louder, and maintains its dynamic performance when pushed hard, where the S30 loses some composure at high levels into the more challenging load. But again, this is at a high listening level, beyond

where I would normally listen and a level that I wouldn't maintain for more than a few minutes.

I found the volume potentiometer offered a very useable range of adjustment with most headphones. Only highly sensitive IEMs required I keep the control at its lower limit. There is no gain adjustment (as above), and there is a degree or 2 of rotation at the bottom end of the pot where channel imbalance can occur. However its position was well beyond that, no matter which headphones I was using. And the same was true for active speakers and amplifiers once I had their gain set correctly.

Michael designed the Spartan 30 primarily as a headphone amp and a line stage to facilitate using active studio monitors for home audio. This isn't as silly as it sounds. Active monitors pair amplification with a loudspeaker, usually with some form of electronic crossover or tuning via digital signal processing (DSP). Active monitors are sold into the pro audio market and you aren't therefore paying the audiophile tax, so more often than not you're getting real value for money.



<https://i0.wp.com/www.audioappraisal.com/wp-content/uploads/2024/02/Front-face.jpg?ssl=1>

And for smaller spaces or discrete setups, they make a lot of sense. You could pair the Spartan 30 with a WiiM Pro Plus to handle streaming duties, a

matching Spartan phono stage, one of the little Pro-Ject CD players, a turntable and a pair of Kali Audio LP6s or IN-8s, for example, and you'd have a killer system for under a grand that will rival a lot of big name, big-money hi-fi. If you want linearity and neutrality, pair it with a pair of Kali's or Tannoys. If you wanted a bright sound, a pair of [Yamaha HS-8s](https://www.audioappraisal.com/yamaha-hs-8-8-active-studio-monitor-speakers-reviewed/) <https://www.audioappraisal.com/yamaha-hs-8-8-active-studio-monitor-speakers-reviewed/> would fit the bill. If you want a warmer sound, look at monitors from RCF or Presonus.

The Spartan 30 isn't perfect. It's a tad pricey (though by no means unreasonably so) as it is a low-volume handmade unit. There's no remote control, no gain control independent of the master volume, no balanced input and no balanced headphone output. But it is wonderfully tactile in a way that most rivals aren't, with its chunky switches analogue volume knob and chunky enclosure.

And it provides plenty of clean headphone power with terrific load-driving ability for line amplifiers, providing they have adjustable gain. It will play nicely with any compatible source device, and it provides clean, uncoloured attenuation or gain from input to output, which is precisely what a preamplifier is supposed to do. And with that I'm forced to type a sequence of characters I don't often entertain in these pages; I was wrong. There might be a plethora of head amps on the market, but the Spartan 30 is better than most of them. So despite its lack of convenience features and amplifier compatibility concerns, it's a viable product that I hope will grace many systems. Fine work, Fidler.



## By Ashley

I founded Audio Appraisal a few years ago and continue to regularly update it with fresh content. An avid vinyl collector and coffee addict, I can often be found at a workbench tinkering with a faulty electronic device, tweaking a turntable to extract the last bit of detail from those tiny grooves in the plastic stuff, or relaxing in front of the hi-fi with a good album. A musician, occasional producer and sound engineer, other hobbies include software programming, web development, long walks and occasional DIY. **[Follow @ashleycox2](https://twitter.com/ashleycox2)** <  
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### 2 comments



Nikolay Petkov

**[February 7, 2024 at 6:38 pm](#)**

Very detailed review of the amp's features, thank you. There are some details mentioned here which are absent from Michael's own documentation. I didn't expect the amp to sound anything but excellent, and I'm glad a credible source confirms this.

Like



**[Ashley](http://www.ashleycox.co.uk)** <**<http://www.ashleycox.co.uk>**>

**[February 7, 2024 at 7:36 pm](#)**

Thank you. I try to work closely with manufacturers in all of my reviews to share as much detail as possible. When you're working with public relations

teams or distributors this can be more of a challenge as they often aren't technically-minded themselves, or they're not able or willing to share in-depth detail on the technical aspects of a product. A lot can be surmised through a general understanding of electronics theory, but that isn't always the case. I'm grateful that Michael is willing to work closely on the detail and has always been completely transparent in every aspect of his circuit design and implementation. This allows me to provide a more thorough objective review, which is what I believe the audio industry desperately needs.

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