

Antony rediscovers a class-A bias

Manufacturers of consumer electronics always find ways around good sound. This started in the 1930s, before there was hi-fi, when AM radio and movies ruled. I wasn't around then, but I did catch up with many 1930s radios, still in the house and still working when I was a kid. It's a sound I remember. Music came first, sound second.

In the early 1930s, makers of radio receivers quickly learned that single-ended-triode (SET) tube designs were cost-ineffective. Push-pull designs delivered more high-power punch at far lower construction costs.¹

You know those iconic "single-ended-triode" output tubes from the 1930s that today's SET sect so treasures—tubes like the 45 and 2A3? They were almost always used as a push-pull pair to deliver a mighty 4 or 5W, and more high-power punch than would have been possible with single-tube (and single-ended) triode.

How did you explain to a radio buyer in the 1930s that a 2W radio at twice the price might sound better than a 4W radio? It did, but you didn't. I knew some people who sold radios and phonographs in the 1930s—my Uncle Stan, for instance.

A frustrated Paul Klipsch once declared, "What this country needs is a good 5W amplifier." If you had a 5W amp, you'd be cool with a Klipsch speaker!

The golden age of SET never existed—unless you mean the last 15 years. Some in the SET sect have compared push-pull to the forbidden fruit that caused the Fall and Adam and Eve's expulsion from Eden (which apparently was somewhere in Iraq). You have to

watch that Tree of Knowledge, especially in hi-fi. So many engineers know so much and hear so little.

Right now, I'm passing wind. Maksim, our cat, seems not to mind. This fart is single-ended; it could not exist with such immediacy in push-pull. All sounds that we hear in nature—or in concerts of acoustic (unamplified) music—are single-ended. There is no crossover distortion at Carnegie Hall or Symphony Hall.

Hi-fi first took off in the mid 1950s, by which time I was very much around. Stereo wasn't yet commercially avail-

owned American entities. It took new, upstart companies to revive the North American hi-fi industry: Threshold. Conrad-Johnson. Audio Research. Krell. Quicksilver Audio. Many of them made tubed gear. Others sought to improve the sound of solid-state.

The titans of audio journalism—including Len Feldman, Julian Hirsch, and our own J. Gordon Holt—paid little attention to these upstarts. Or to tubes. Speaker manufacturers (except for Klipsch and a few others) eagerly joined the chorus and produced small, cheap, insensitive speakers. It was win-

MANUFACTURERS OF CONSUMER ELECTRONICS ALWAYS FIND WAYS **AROUND GOOD SOUND**.

able, although it had been invented two decades earlier by a Brit: Alan Blumlein. All systems were mono, and all gear was tubed. If there were any great single-ended amplifiers of the 1950s—hobbyists might have built some—I don't know about them.

Things got worse when transistors came along. William Shockley, of AT&T's Bell Labs, is widely considered to be, though seldom revered as, "the father of the transistor"² [*along with John Bardeen and Walter Brattain—Ed.*]. The idea of the transistor had been put forth earlier but not developed. Shockley ran with it.

Texas Instruments produced the first commercial silicon transistors in 1954 and sold them to Japan. Soon, upstart Sony began making miniature transistor radios that every rich kid in America *had* to have. Tiny radio, tinny sound—a recipe for success, just as it was to be later on with iPods, downloads, and MP3s.³

Few people realized it back when, but transistors sealed the fate of such companies as Fisher, H.H. Scott, Sherwood, and Marantz as independently

win for everyone and good for commerce; once again, as with SET, sound quality lost out.

In 1974, Nelson Pass, with René Besne, founded Threshold. Also in 1974, David Reich established Classé Audio, just outside Montréal. In 1980, Dan and Rondi D'Agostino launched Krell Industries, whose name derives from the lost alien race of the movie *Forbidden Planet* (1956). Across the pond, in London, a young Antony Michaelson started Musical Fidelity on his kitchen table in 1982. All four companies produced solid-state class-A amplifiers—and for a while, in the cases of Krell and Classé, *only* solid-state class-A amps.

The road back to sound quality has been long and hard. *Stereo Review* magazine stood in the way, as did *High Fidelity* and *Audio*. What could be measured was measured. Such testing is much easier than going out on a limb and, say, *listening*.

There's a lot of hi-fi history online—Google around, or try Wikipedia. Because to understand Musical Fidelity's new class-A integrated amplifier, the AMS35i, you'll need to bone up a little.

Musical Fidelity AMS35i integrated amplifier

The AMS35i is claimed to deliver 35Wpc into 8, 4, or 2 ohms—to double

1 A single-ended amplifier passes a full 360° waveform. It must, of necessity, run in class-A. To avoid magnetic saturation for the DC current passing through it, a tubed single-ended amplifier needs a large, expensive output transformer. In a push-pull amplifier, the push side of the output device pair handles the positive 180° degrees of the waveform, the pull side the minus 180°. The problem is that the plus and minus sides never exactly line up—there's always some crossover, or notch, distortion. A minimum of two tubes (or output transistors) is needed for each push-pull channel, which itself is part of the problem: matching. Of course, there was only one channel in the 1930s, and no transistors.

2 This was long before Shockley shocked the world by declaring that blacks were intellectually inferior to whites—according to tests devised and controlled by whites.

3 There are those who still say that the sound quality of 78rpm records can far exceed that of 33.3rpm LPs.



Musical Fidelity's AMS35i integrated amplifier.

its power into 4 ohms, it would have to roughly double in size, Antony Michaelson claims. It retails for \$8999, which works out to \$257.11 per stereo watt. Remember NAD's C 375BEE integrated amp, which I reviewed last October? It puts out 150Wpc into 8 or 4 ohms and sells for \$1299, or \$8.66 per stereo watt. What's going on?

Class-A amps are expensive to build and expensive to operate. They'll cost you so much green and they aren't very green. The AMS35i draws 330W from the wall at all times, whether or not music is playing.⁴

All single-ended amplifiers are class-A, but not all class-A amplifiers are single-ended. Most, in fact, are not. Single-ended only compounds the problem of too few watts for the dollar. Besides, who are you and I, with all our sins, to reclaim Eden?

Nelson Pass has said on several occasions that push-pull designs "have no particular basis in nature." Remember, nature is single-ended. That's one reason why a windup gramophone tricked Nipper, the famous Victrola canine, into thinking he was hearing His Master's Voice. You couldn't have fooled Nipper with push-pull.

A class-A push-pull amplifier eases, but does not eliminate, the problem of crossover distortion, aka notch distortion. You'll remember that 360° waveform—180° positive on top, 180°

negative on the bottom. There's still that handover from positive phase to negative phase—the push and the pull—which, if not counter to Mother Nature, isn't in consonance with Her, either. With such a class-A amplifier, you need at least one pair of output transistors per channel. Usually you have multiple pairs, and in such designs these usually are bipolar output transistors.

One output transistor (or set of output transistors) handles the positive half of the waveform; another output transistor (or set of them) takes care of the negative half. There are those who believe that having just two (a single pair) improves the sound quality. That's another tale. One pair per channel would likely yield a maximum of 15, maybe 20Wpc.

There's still the problem of joining the two halves of the waveform—something that can't be done without at least some gap—which, among other things, compromises instrumental and vocal timbres and reduces ambience. This is why Giovanni Sacchetti, of Unison Research, always prefers single-ended when cost is no object. (One such delicious example is now on its way to me from Italia.)

In a class-A push-pull amp the transistors are always on, drawing full power from the mains whether or not they're conducting a signal. In a class-A/B amp, the output transistors switch off when they're not doing anything. On, off, on, off—continually on and off. As you can imagine, such switching doesn't do much for the sound quality—any more than it does in a class-D power amp.

Many of the great solid-state power amplifiers were pure (or putatively

pure) class-A, including: Threshold's SA1, SA2, and SA3; Krell's KSA-50 and KSA-80; Classé's DR-7; and Musical Fidelity's original A1 integrated of 1984, a 20Wpc amplifier I reviewed here in January 1986 (Vol.9 No.1). I've had ears-on experience with all of these amps. Each was special, and they shared a certain commonality of sound quality—much as SET amplifiers do.

There is about class-A amps a certain sweetness, or purity, of sound—a lack of midrange, and especially high-frequency, harshness. There is also superb transient response: triangles tingle, cymbals clash, and brass instruments, while burnished, have bite. I have never heard a bad-sounding class-A solid-state amplifier.

Many of the best solid-state amplifiers operate in class-A for the first 5–10W, then slide into class-A/B. This means they still run hot. One of the best of these was James Bongiorno's (Bongo's) legendary Son of Ampzilla, which ran in class-A most of the time.

There's another disadvantage to hot-running amplifiers that manufacturers would rather not talk about. It stresses components, especially capacitors, which have a tendency to dry up and short out over time. You're unlikely to go 20 years without service, as you can with some cool-running, well-designed class-A/B amps.

All of this explains why so many manufacturers who made class-A amplifiers turned away from the technology—and why most makers of solid-state amps never adopted pure class-A in the first place. Often, manufacturers have devised various sliding-bias schemes that prevent the transistors from turning on until the music comes along; these amount to different ways of implementing—and even more clever ways of marketing—class-A/B.

The best-sounding Krell I ever heard was the pure-class-A Krell KSA-80. John Atkinson is so fond of the earlier KSA-50, Krell's first amplifier, that he still has the sample he bought following his review in the August 1983 issue of *Hi-Fi News* magazine. I'm still haunted by the memory of having once owned—and then foolishly sold—a Threshold SA-3.

I'm also haunted by the original 1984 Musical Fidelity A1 integrated—although that amplifier may have been too small for its 20Wpc ambitions. It ran very, very hot. Some wags suggested that you could boil water for tea on the top heatsink—highly dangerous, if true, which it wasn't. When cooking, the heatsink

⁴ Such amplifiers may soon be outlawed in Oz (Australia), where the Labour government looks set to mandate that all hi-fi gear sold in Australia after 2012 must consume no more than 1W in standby mode. See Greg Borrowman's review of the AMS35i in the January/February issue of *Australian Hi-Fi* (p.22). How long before Mikey Framer's and Art Dudley's political heroes suggest the same?

that was the roof of the A1 ran 131–140°F (55–60°C)—too hot for my kitty of the era, the late, lamented Catlor. By contrast, the Musical Fidelity AMS35i does *not* run too hot for Maksim Koratskii (Max, our Korat).

I pause for a Nelson Pass cat story: Long ago, the owner of a Threshold class-A amp called Nelson with a tale of woe. His aging cat liked to sleep atop his owner's Threshold amp. The poor old cat lost control of his bladder and pissed on Pass's amp, which went up in a shower of cat piss and a plume of smoke. Fortunately, the feline survived. The amp did not. I don't remember whether Nelson was able to save the casework and heatsinks.

The Musical Fidelity AMS35i has one pair of balanced line-level XLR inputs, four pairs of RCA line-level inputs, a pair of fixed-level RCA tape outputs, and, for biamping or subwoofering, a pair of variable preamp outputs. There is no built-in phono stage or onboard phono option, and no headphone amp. (Antony M. charges separately for that, and in terms of maximizing sound quality he may be right. A new class-A solid-state headphone amp is on the way from him; it can be used as a line-stage, too.) The AMS35i comes with a faceplate colored silver or charcoal black.

The AMS35i is heavy—62.3 lbs (28.3kg). It's big, too, because it has to be: 18.8" (483mm) wide by 5.8" (148mm) high by 18.5" (475mm) deep. As mentioned, the thing consumes 330W of electricity *all* the time it's on. Antony suggests that you *not* leave it on all the time. I suggest that you leave *no* amplifier on all the time. He suggests 30 minutes or so of warmup; time to come on song—or on flame, as it were.

Saving green (as opposed to going green) is not what class-A amplifiers are about. Still, there's that element of frugal-



Inputs on the inside, outputs on the outside.

ity, as Antony averred: "You are buying only one set of metalwork [with an integrated amplifier]. Metalwork gets more expensive all the time. I am continually astonished by how much costs continue to rise." He continued: "There's an electrical advantage, too—that the ground point is exactly the same for the preamp section and the power amp, which is 0V. This makes a substantial difference in noise, or the lack of it."

That's not the only advantage. With an integrated, you need not spend \$500 or more on a pair of audiophile-approved interconnects to connect your pre- and power sections. It's already connected for you, free of cost and dealer markup. The best interconnect is no interconnect.

The AMS35i's design is dual-mono: "Inside, you have two separate mains transformers, and each transformer has a power supply for the preamp and the output stage. You have, in effect, a class-A preamp and two separate monoblock class-A amplifiers inside one box."

I asked Antony about the output transistors, knowing in advance his answer: "We use bipolars, of course," he replied, dismissively. "There is no excuse for using MOSFETs now. You simply cannot get the peak current that you need to drive the loudspeakers."

We chatted about class-A: "I don't understand it," said Antony, "but class-A amplification sounds more powerful than it is. I find it uncomfortable not to be able to measure it and say why this is the way it is, but it is. I know for a fact that this amplifier measures pretty well the same as our class-A/B amplifiers. We measure all these things assiduously."

Assiduously. You have to be British to use a word like that. He continued: "You get a much richer, fuller sound. It sounds like an octave more in the bottom end. Because it has this richer, full-

er sound, it gives the illusion of playing louder. I have not fully formed my thoughts on this. I know for a fact that my pure-class-A amplifiers have almost no distortion. I know the sound quality is not due to stuff being added."

I asked Antony about class-A/B amplifiers. After all, you can richly bias an amplifier into class-A—10W or so—then have it slide into class-B. "This is where the argument begins to get much more sensitive," he said. "You could

argue that 85 or 90% of the music is at 1 or 1.5W, or something like that. You could say that a particular class-A/B amplifier has 2 watts' worth of standing current, so that's enough that the vast majority of the signal doesn't have to switch on the class-B output stage. All this seems very plausible. But there is something else going on here. Is there some inherent advantage in the amount of bias you have?"

I brought up the issue of economy.

"You could put the [AMS35i] in a plain-Jane box and people wouldn't believe its sound quality. It's the same way with a car. You could buy the cheapest, tattiest car, and its functionality would be the same as a car that's ten times the price. But how would you feel about driving it?"

I brought up the subject of power conditioners and power cords. I do like to roil Antony.

"My experience of so-called power conditioners is that they do more harm than good. Those which generate the mains are fraught with problems that can cause oscillation and upset the amplifier. As for power cords, I find the whole thing ludicrous. Who knows what happens between you and the local generating plant—the fuses and step-up transformers, and whatever else? If someone believes that three or four feet of power cable can make a difference after miles and miles of utility cables, I just can't buy it.

"But the real issue is the misallocation of resources. Instead of spending thousands of dollars, or pounds, on bullshit power cords, interconnects, and speaker cables, you could have bought yourself a really big amplifier for the same money, and you would have a proper hi-fi system to show for it."

So how did the Musical Fidelity AMS35i sound? I knew you'd get around to asking.

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Sound

I used my Denon DCD-1650AR CD player as a disc transport with the Cambridge Audio DacMagic. (I would have used Musical Fidelity's V-DAC, but I'd given it to my son for his birthday.) The interconnect cables were—

Oh, no. Why would you want to know? I did run balanced from the DacMagic to the balanced inputs of the AMS35i. This seemed to result in a quieter signal and a slightly more open, dynamic sound—no big deal, however. The speakers were ideally suited to the AMS35i: Opera Loudspeakers' new Grand Callas floorstanders, whose US retail price had not been set at time of writing; probably \$18,000–\$20,000/pair.

I heard stunning class-A solid-state sound: rich, full-bodied, sweet, harmonically pure. I'm most engaged when an amplifier and system sound harmonically right—with all the notes in register. I am not particularly interested in tapping my toes or snapping my fingers. I will not prattle on about PRAT—pace, rhythm, acceleration, and timing.

I thought that the AMS35i was particularly kind to older and less-than-perfect recordings. For instance, I listened to Clifford Brown and Max Roach's *At Basin Street* (CD, EmArcy/Mercury). I still have the original EmArcy LP from when I was a kid. Max and Clifford were alive again. The tonal color of Clifford's trumpet! The clean, clear transients of Max's drums! Who cares that they were recorded in mono?

I tried Leonard Bernstein's final recording of Tchaikovsky's Symphony 4, with the New York Philharmonic (CD, Deutsche Grammophon 429 778). This is not my first choice in terms of sound quality or performance—the first movement is willfully, almost perversely slow—yet it *is* Bernstein on the podium. And with the Musical Fidelity AMS35i, it was easy to hear how the maestro shaped each phrase. The woodwinds were ravishing.

The AMS35i had a way of ameliorating the less than perfect, especially digital recordings or remasterings. It might seem superficial, but, like all great class-A solid-state amplifiers, the AMS35i had a way of making digital sound more like analog—which is to say, more musical and less like a contrivance.

I don't think this last quality is any more amenable to measurement than is the full, rich sound, or the breathtakingly immediate harmonics. While its bass was ample, as Antony Michaelson noted, I didn't find that the AMS35i

got the greatest grip on the speakers in the bottom end. The more powerful NAD C 375BEE excelled in that regard. Was this a consequence of class-A, or did it have more to do with 35Wpc as opposed to 150Wpc? Those looking for grab-ass bass might be better off looking elsewhere. The AMS35i is not about bang for the buck.

My other complaint has to do with the remote control, machined from what I assume is a solid block of aluminium. This amazing remote weighs 17.5oz (497gm)—just over a pound, almost half a kilo. Someone has thoughtfully placed six plastic bumpers on its bottom to protect the furniture. Even so, if you drop this remote just the right way, I think you could damage your furniture or floor. Its corners are *very* sharp. Worse, it has a hair-trigger action.


I can't blame Maksim for this: In stacking another remote atop the AMS35i's remote, I inadvertently pinned the latter's volume control—it went all the way up. I also drained the VATA Lithium Li-Mn button battery. Next time I turned on the amp, the volume was full-blast and full of distortion. I'm lucky I didn't blow out my speakers.

I'm sorry—I just hate this remote. I

wasn't going to go to RadioShack to shell out \$8 for a new battery, and I wasn't pleased that the bottom plate is held in place with six tiny screws. What if you lose one? Eventually, you will.

Fortunately, I had another Musical Fidelity remote—a cheesy plastic one—with the same codes. That's what I've been using. It weighs only 4.06oz (115gm) with its two AAA batteries installed. Perhaps Musical Fidelity can make both remotes available. You could keep the fancy-schmancy remote in its box and adore it from time to time, or take it out to show off to guests—or keep it pristine in its case for the day you sell the amp. Meanwhile, the plastic remote is far more user-friendly and furniture-safe.

More quibbles. While the AMS35i's exceptional build quality is what you'd expect for the price, I found its heatsinks exceedingly, perhaps dangerously sharp. They should be rounded. Unless you carry this amplifier just so, you can cut your hands. Krell, too, used to be famous for killer heatsinks.

I've enjoyed my time with the Musical Fidelity AMS35i, and when I return it, I know its remote control will be in perfect condition. Not a scratch on it. Or on my floor or furniture. 

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