FUN WITH PASS-SIT-1

by Michael Rothacher

Unobtanium Obtained

This isn't really a technical article, and it isn't really a review, it's more of a techni-gonzo piece about Nelson Pass' new Static Induction Transistors.

Okay, here's the deal. A couple of months ago I wrote an article about a really simple SIT amplifier that used Sony 2SK82s and light bulbs. I did this because curiosity got the better of me after reading that Pass had his own special batch of Static Induction Transistors custom made for him by SemiSouth. I really didn't know much about Static Induction Transistors, but I figured if Nelson was spending his Ferrari money on them they must be pretty sweet.

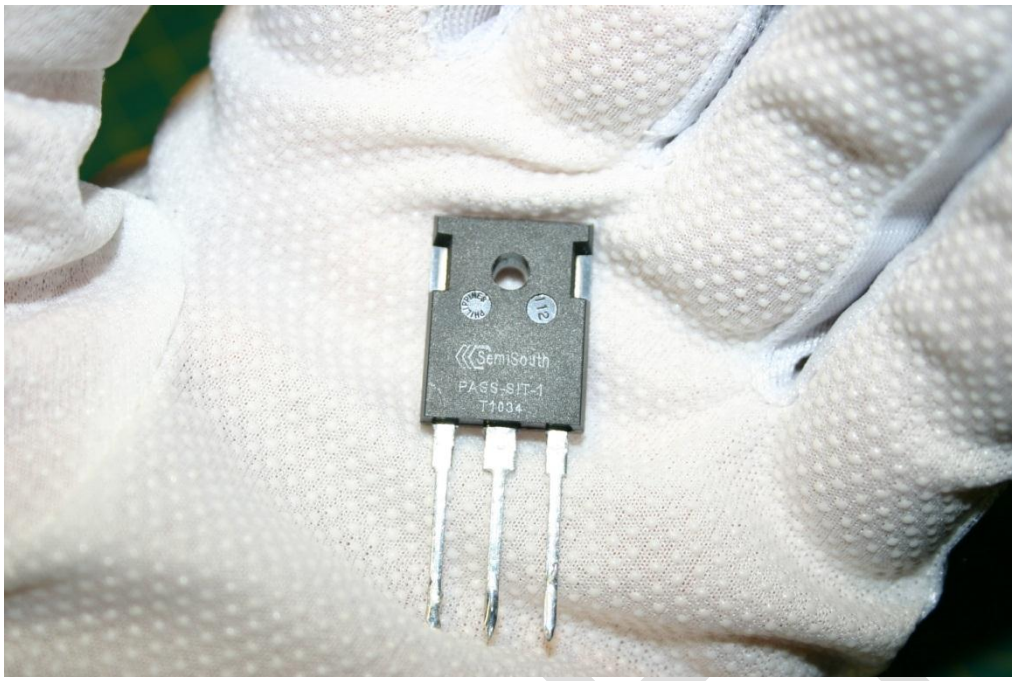
I built up a few amps with the Sony parts and was pleased to find they performed well and sounded really good. Writing-up the project was fun and educational, but things got a lot more interesting when Nelson offered to send me a pair of his PASS-SIT-1 transistors.

Let me type that again.

Nelson Pass offered to send me a pair of his PASS-SIT-1 transistors.

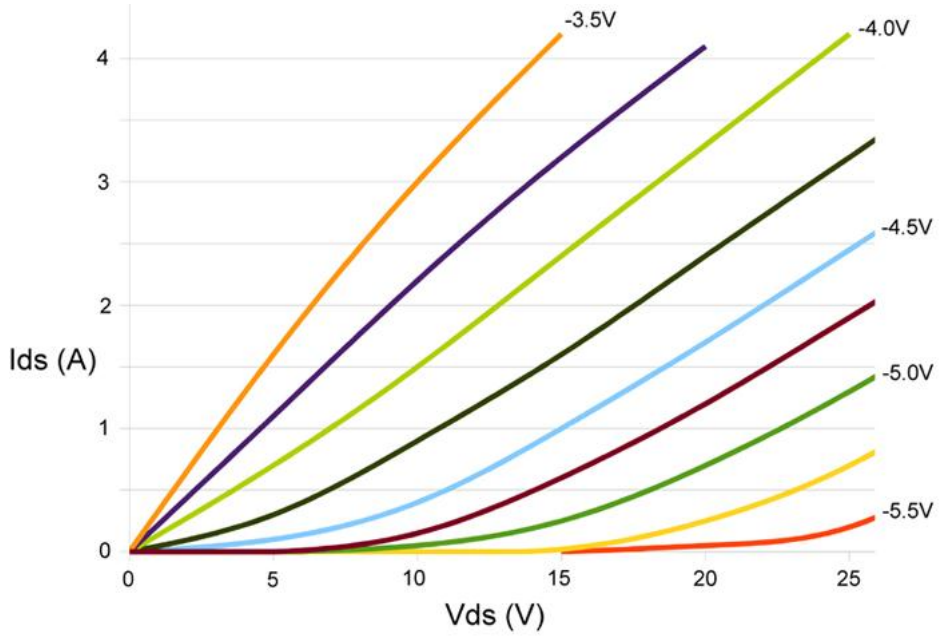
Maybe Nelson bumped his head or something; I don't know why he'd make me this offer, but believe me, I don't question it. For me, this was like George Lucas inviting a random fan to Skywalker Ranch to preview one of the Star Wars films. And I don't mean Phantom Menace.

A few weeks later they arrived in my mailbox and I went to work. Here's a picture of me holding one.



The anti-static gloves probably weren't necessary, but I thought perhaps they shouldn't be handled by *human* hands.

The PASS-SIT-1 is a silicon carbide static induction transistor. It shouldn't be confused with other SemiSouth power JFETs Pass has used in his designs. The PASS-SIT-1 has a characteristic curve which looks a lot like a triode vacuum tube and has been scaled to work specifically with audio loads. Here's what it looks like.



TYPICAL SIT CHARACTERISTIC CURVES

The first thing I did was build up a couple of modules for testing. These allowed me to quickly switch the SITs in and out of different circuits without un-mounting or de-soldering; after all, these things are rare unobtanium. Here's a picture of the modules.

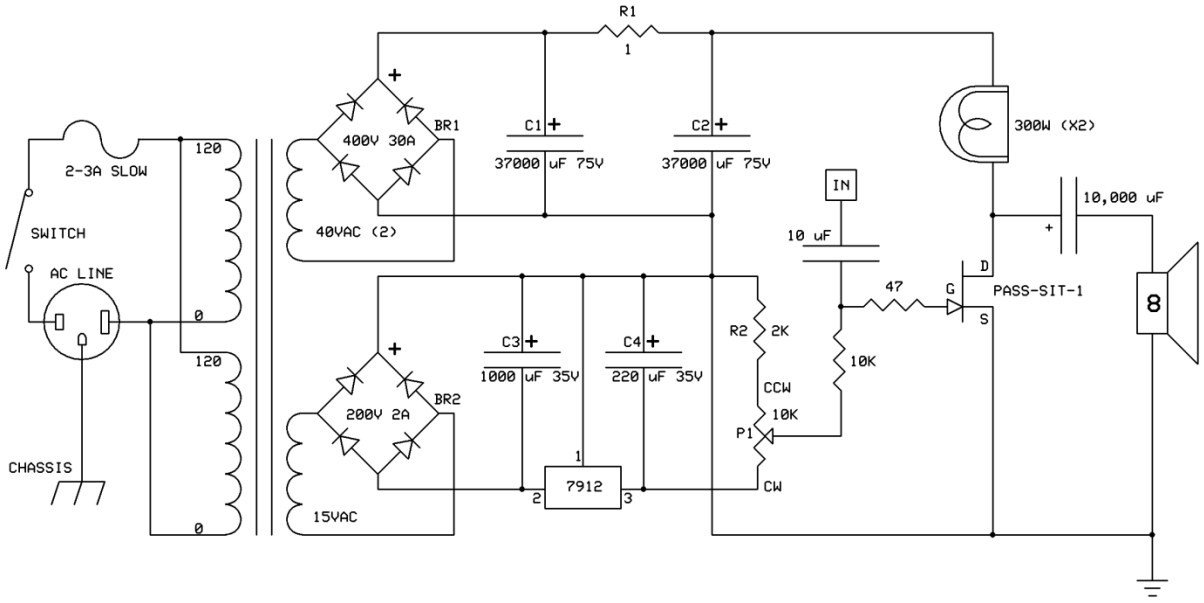
My goal was to try these in a simple amp like L'Amp/DeLite and report my findings to you. I chose this goal for several reasons:

1. I already had all the required parts.
2. I'm not very interested in cloning or reverse-engineering.
3. I really dig the light bulb amps.
4. It just so happens that these parts are *ideal* for simple circuits.

Pass sagely realized that last point some time ago; SITs aren't new, but they've generally been used in more complex circuits even though their unique properties make them especially suitable for use in minimalist amplifiers.

The Circuit

I used the same circuit from the first L'Amp article, but I lowered the input resistor value to adjust for my sample SIT's 100uA gate leakage current. Everything else is the same.



Finding the Sweet Spot

Once I had the channels built, my next task was to find the sweet spot for the PASS-SIT-1s. I tried a number of different power supply voltages and

currents along with different drain and speaker loads. Here are my findings:

1 300W Bulb, 8 Ohm Speaker

V(supply)	V(ds)	I(d)	V(bias)	V(drain load)	1W THD%
40	13.35	1.18	7.6	26.36	0.259
45	14.86	1.26	7.8	29.7	0.213
50	15.71	1.35	7.9	33.86	0.189
55	17.2	1.42	8.1	37.2	0.175
60	17.95	1.5	8.2	41.4	0.155
65	18.79	1.57	8.3	45.4	0.146
70	19.44	1.66	8.4	49.8	0.133
75	20.37	1.72	8.5	53.7	0.115
80	20.73	1.8	8.5	58.6	0.105

2 300W Bulbs, 8 Ohm Speaker

V(supply)	V(ds)	I(d)	V(bias)	V(drain load)	1W THD%
35	15.14	2	7.6	18.96	0.177
40	17.1	2.15	7.8	21.94	0.144
45	18.6	2.3	7.9	25.22	0.14
50	19.57	2.49	7.9	29.47	0.108
55	20.6	2.65	7.9	33.2	0.098
60	21.7	2.8	7.9	36.9	0.106

2 300W Bulbs, 4 Ohm Speaker

V(supply)	V(ds)	I(d)	V(bias)	V(drain load)	1W THD%
40	12.34	2.36	7.00	26.56	0.264
45	12.97	2.54	7.00	30.72	0.231
50	13.71	2.72	7.00	35	0.201
55	14.42	2.87	7.00	39	0.163
60	15.21	3.03	7.00	43.1	0.148

1 300W Bulb, 12 Ohm Speaker

V(supply)	V(ds)	I(d)	V(bias)	V(drain load)	1W THD%
40	16.14	1.1	8.10	23.22	0.239
45	18.31	1.17	8.40	25.95	0.199
50	19.87	1.25	8.60	29.58	0.176
55	20.61	1.33	8.70	33.5	0.155
60	21.54	1.42	8.80	37.5	0.154

I settled on a 50-55V supply at approximately 2A bias, with two 300W bulbs. That keeps the dissipation below the recommended 50W maximum and offers good performance with varied loads.

The Measurements

This amp measures really well. Firstly, the PASS-SIT-1 offers respectable gain at around 17dB. This is a big improvement over the Sony 2SK82s. Figure 1 shows distortion vs. power.

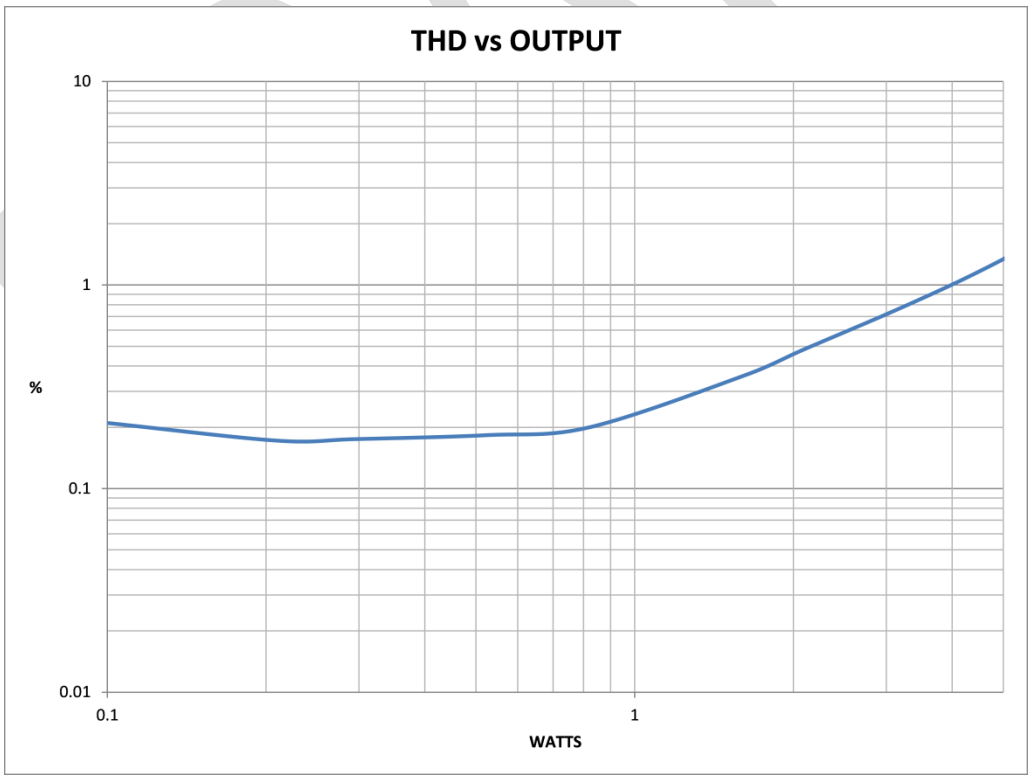


FIGURE 1

17dB gain and 1 watt distortion in the vicinity of .2% in a zero-feedback amplifier is pretty impressive.

Figure 2 is the distortion vs. frequency at 1 watt and it's amazingly flat.

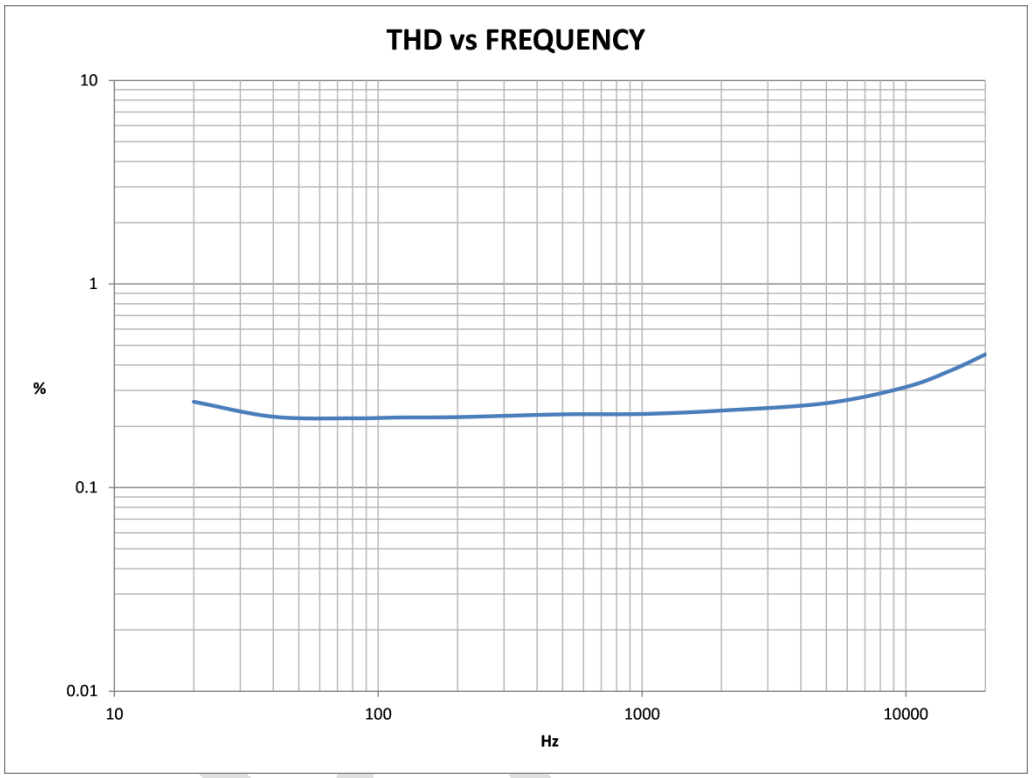


FIGURE 2

Figure 3 is our square wave at 40 kHz.

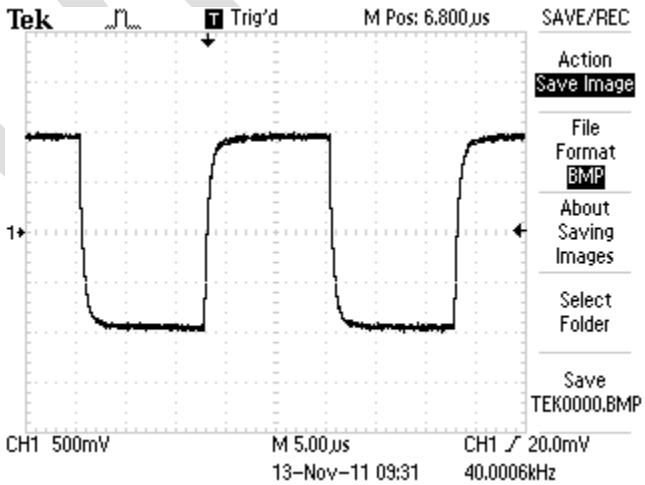


FIGURE 3

The Sound

So how do these things sound? Well, first I'll say I think these are great amplifiers. In fact, I think they're among the best amps I've ever listened to DIY or commercial. The usual low-power and speaker matching caveats apply, but beyond that I don't feel any need to qualify my assessment.

The soundstage is particularly impressive. The images are life-sized and really seem to occupy physical space in the listening room. Everything seems vivid and realistic. This quality is often associated with zero-feedback SE triode amps, and solid state amps rarely pull this off well. These PASS-SIT-1 amps not only pull it off, they pull it off with sharp focus and great specificity, without the fuzzy edges and image drift that vacuum tubes sometimes impart.

Tonally, I'd place them slightly on the warm side of neutral, which is what I like. The highs are extended and have a slight sweetness; the lows were nicely taut and tuneful, free from one-note bloat. They do a beautiful job of rendering timbre with fine detail and bell-like clarity.

Speed is also remarkable. This isn't the kind of amp you'd expect to sound fast, but it certainly does. Attack transients are nicely energetic and have a very real feel. The excellent speed and soundstaging combine to create the fantastically convincing illusion that the instruments are in the room with you.

Dynamically speaking, they're terrific within their power limitations, but despite their low power, they don't seem to collapse into a jumbled mess on complex passages or singe your eardrums on a clip.

All of these qualities make for a very musically engaging and emotional experience. I could live with these amps for a long time.

So, has Nelson Pass captured lightning in a bottle?

You bet he has.

Outro

The high-end audio industry is ostensibly all about innovation, but in actual fact it has its fair share of taboos and groupthink. Nelson Pass brings much more to our hobby than his knowledge; he also brings a healthy bit of irreverence and a “think different” outlook that gives us all permission to try crazy stuff even if it bends the rules of conventional wisdom. I’ve called Pass a paradigm shifter elsewhere and I really think it’s a fitting title; from dynamic bias, to single-ended solid state, to amps with one transistor, Pass does stuff others dismiss and in doing so advances the art. And now, we have a cool new gain device made just for audio that blurs the line between solid-state and tube sound *for real*.

The PASS-SIT-1 is currently only available in First Watt products, and I’m sure they’re due to receive a lot of attention. Like me you’re probably wondering if these parts will ever be released to DIY. Honestly, I have no idea. But who knows what tomorrow brings? We’ll just have to wait and see how things unfold. In the meantime there are old stock parts available to experiment with and new ones on the horizon. As for PASS-SIT-1, it can’t hurt to keep your fingers crossed.

I do.