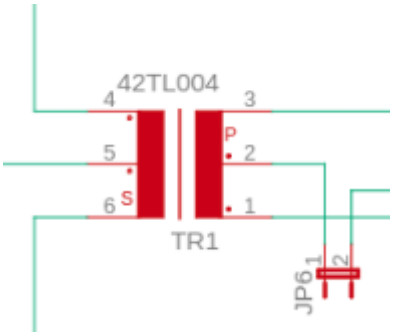
MK-312BT Transformer Question

peteracworth #1 January 1, 2019, 2:01pm

Hi All,

I am confused by the transformer on the schematic



Input #5 I understand - its sourced from the 9+V supply and is in direct relation to the DAC output. I can also stomach the fact that there are three outputs and when JP6 is enabled the output voltage is presumably tapped and equally split to power a tripolar toy.

What I am not understanding is why inputs 4 and 6 appear to be dependent on more pins from the processor (PB2, PB3 and PA0). If anything I'd have expected to see just one other grounded input pin, since all the necessary juice appears to be coming into pin 5.

Can anyone help explain what's going on?

Cheers
Peter

peteracworth #2 January 2, 2019, 4:00pm

OK so I think I am figuring this out. Pins 4 and 6 of the transformers A&B are pulled to GND to an extent determined by outputs PB0,1,2,3 of the processor. PA0 is telling the processor how much juice is actually getting delivered.

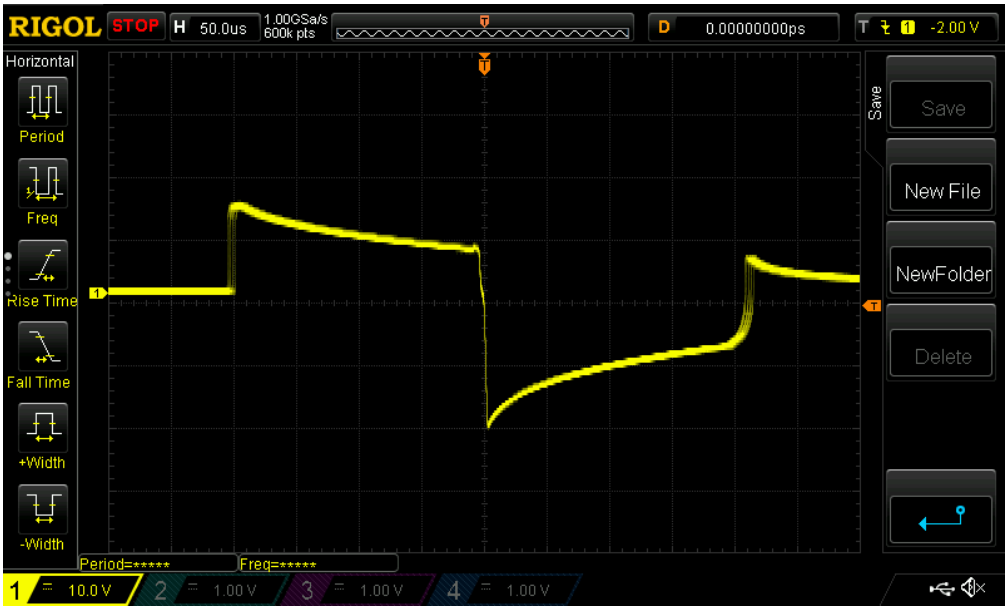
I'm still confused as to why there need to be so many outputs from the processor involved in the output but perhaps all will become clearer in the build.

M.P #3 January 3, 2019, 8:08pm

@peteracworth It's so that we can generate the positive and negative half of the waves by alternately switching the sides on/off - this reveres the direction the current is flowing through the transformer

qdot #4 January 3, 2019, 8:20pm

Here's a scope capture to illustrate what the waveform looks like. (from **@bkifft** , 500 ohm load, 100%MA, 15 on channel A wave)



peteracworth #5 January 3, 2019, 8:46pm

OMG of course that makes total sense!! Here's a video I took of the output on "Orgasm" mode.(my personal favorite) with a 1K load. **https://photos.app.goo.gl/ud4FZkERrH8Qdvb1A** Looks like a very similar shape.

I wonder if the intent is a perfect square wave and the bouncy nature of it is due to the components

M.P #6 January 3, 2019, 9:29pm

The impedence, capacitance, and resistance of your load (human body , electrode , gel) etc are going to drastically affect the shape of your final waveform. In this case it is more important that we have a symmetrical and well controlled wave (which we do)

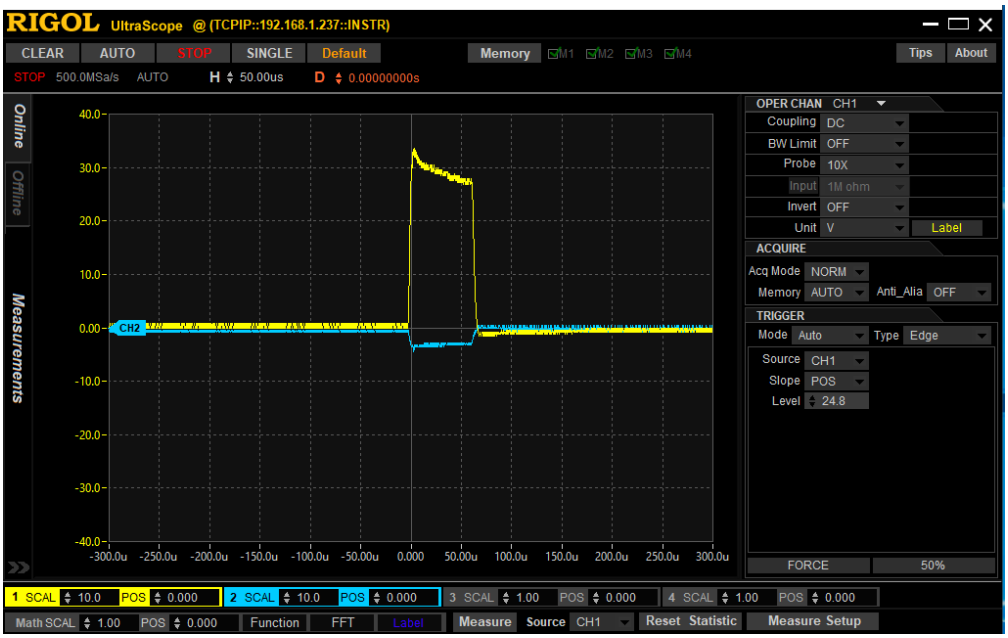
peteracworth #7 January 4, 2019, 3:26am

Yes, certainly good point! (Perhaps the nearby presence of a moist turd may be a factor too 😶) I was just wondering though if the outputs from the processor are purely binary/square - by which I mean is the processor of the MK312 telling the DAC to output a square wave, which is then chopped in the middle by a switch to pins 4 and 6 … or is the output a bit more nuanced?

By the way I just acquired an E-Stim 2B and a Centepede 416. Here are their waveforms, again with a 1k resistor load.

Centepede 416

E-Stim 2B



(I think all of the functions of both boxes come down to variations of this waveform in frequency and width)

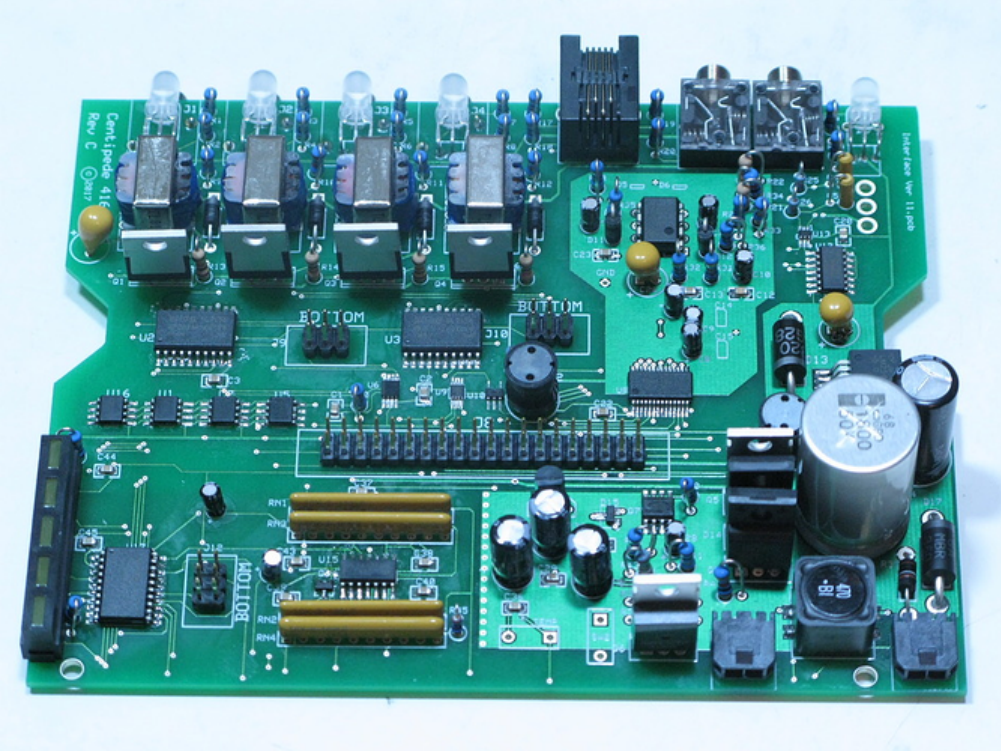
Both decidedly square and one-directional. I.e. the current/voltage DOESNT suddenly flip mid way through the waveform… and I have to say, at least to me they appear to be not as pleasant as the ET-312. Its like with these other boxes you can feel the individual pulses to a greater extent which feels more like getting shocked as opposed to something therapeutic.

There’s obviously significant extra work that has gone into the ability to flip the direction of the waveform in the et/mk312… and I wonder if this aspect is what makes the box seem more pleasant.

voncosel #8 January 4, 2019, 1:01pm

> peteracworth:
>
> There's obviously significant extra work that has gone into the ability to flip the direction of the waveform in the et/mk312… and I wonder if this aspect is what makes the box seem more pleasant.

Exactly right. I was initially interested in the Centipede, but when I saw a picture of its PCB showing only one FET per transformer, I struck it off the list.



Only the ET/MK312 emits "balanced bipolar" (also known as **Lilly's waves**) pulses, which are physiologically compatible and won't cause electromigration in metal electrodes.

A question for the electronics experts: why does the Centipede have a ground plane that only covers certain parts?

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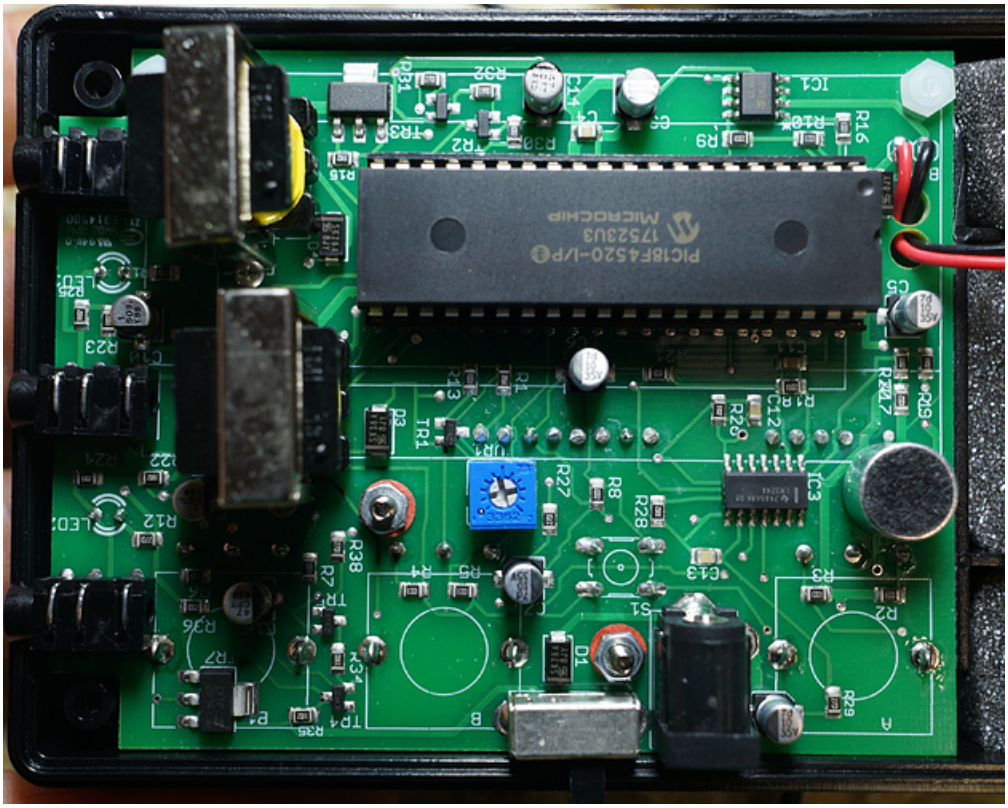
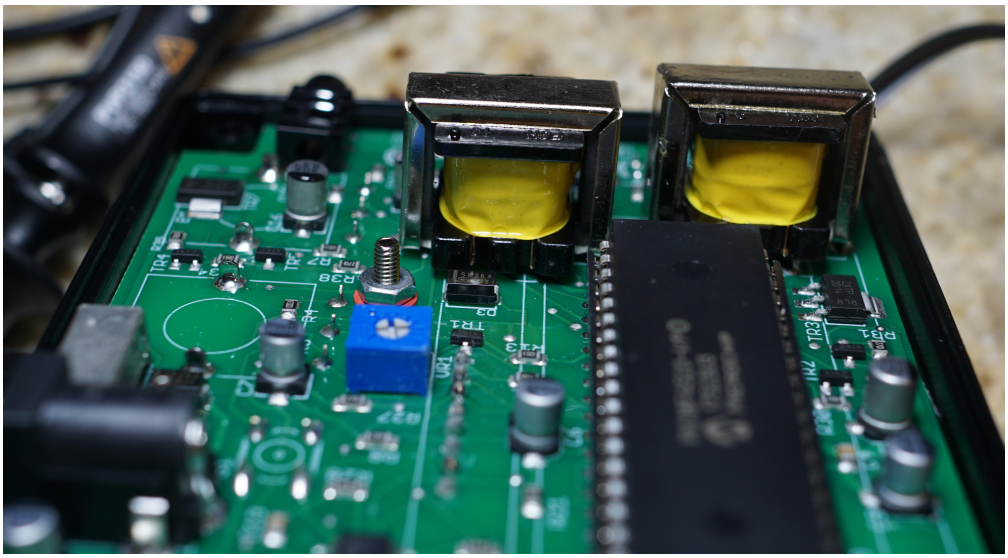
peteracworth #9 January 4, 2019, 4:28pm

Fascinating! Thanks for posing that link about Lilly's waves.

here are shots of the E-Stim 2B board.





Similarly - just one transistor per channel by the looks of things (TR3 and TR7)

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