MK-312BT Failure 20

Zafphod #1 September 17, 2018, 6:26pm

I'm sorry to start this new topic, but my intellect is over. I have a problem with the revival of the MK-312BT. I'll be glad if someone more experienced helps me to discover the cause of the problem.
After turning on, "failure 20" will appear.
Here are the facts:
I use DPS version 1.3B
The BT module configuration firmware has worked smoothly.
(**https://github.com/buttshock/mk312-bt/tree/master/bluetooth_conf**)
I measured voltage on the voltage regulators. In tolerance. The battery is charging well.
I replaced the battery with a laboratory source. I have tried different levels of tension.
He checked and recalculated the voltage dividers, the battery and the power adapter, by the processor.
I checked the processor's programming fuses. (low: 0xFF, high: 0xDC)
I replaced the LTC1661 circuit with the MAX548 circuit. (of course in the right hole)
I have checked the proper casting and orientation of powerful MOSFET transistors.
I have tried different firmware resources:
https://github.com/buttshock/mk312-bt/blob/master/firmware/Custom%20Boot%20Message%20f005-MK312-BT/ElectrodesReady.bin
https://github.com/buttshock/mk312-bt/blob/master/firmware/Custom%20Boot%20Message%20f005-MK312-BT/HelloFriend.bin
https://github.com/buttshock/buttshock-et312-frankenbutt/blob/master/f005/f005.bin
https://github.com/buttshock/buttshock-et312-frankenbutt/tree/master/m005 (I've compiled this firmware in a virtual Linux machine according to the instructions.)

I understand Hardware well, but I do not understand programming very well, and the assembler is not my friend.
It would be helpful if someone explained to me in more detail the meaning of the fault code 20, so that I could jump from something.

Thank you very much for every subject.

MK-312 PCB manufacture

New Estim powerbox design

MK312BT Firmware and function issues (Failure 20), debug suggestions?

qdot #2 September 20, 2018, 5:58am

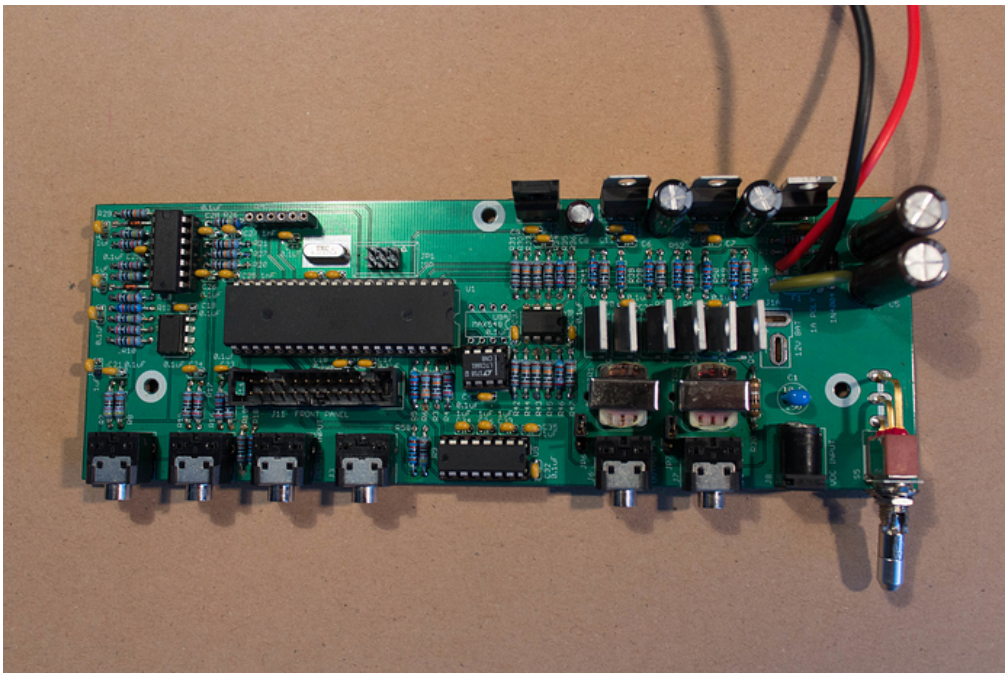
Can you post high rez photos of your populated boards?

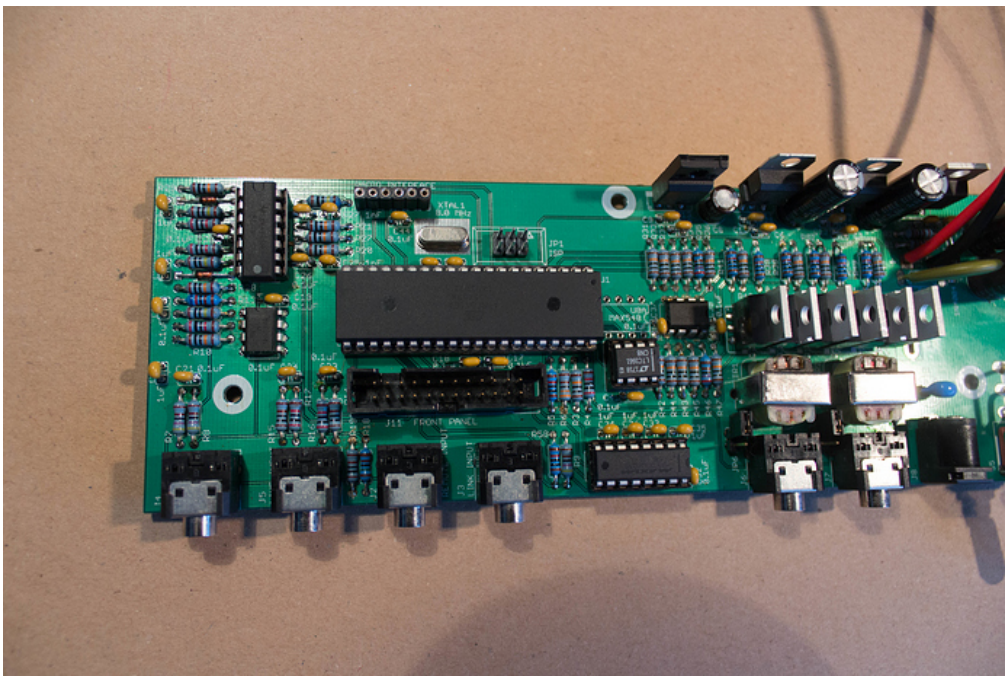
Also, if you've got a scope handy, can you probe across the current shunt on startup and post the waveform?

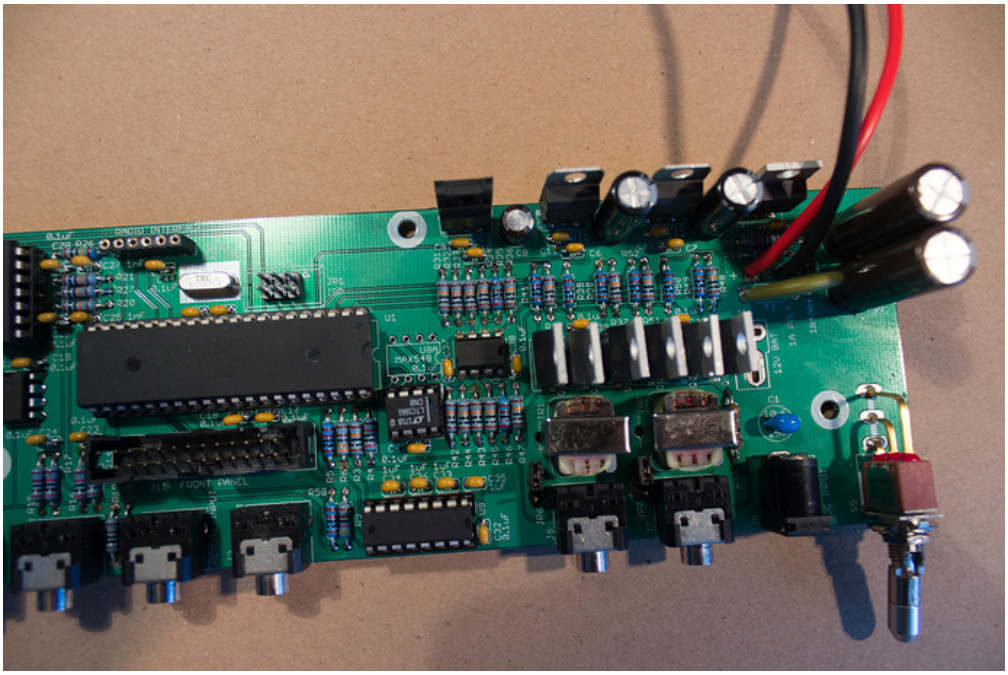
Zafphod #3 September 21, 2018, 10:27am

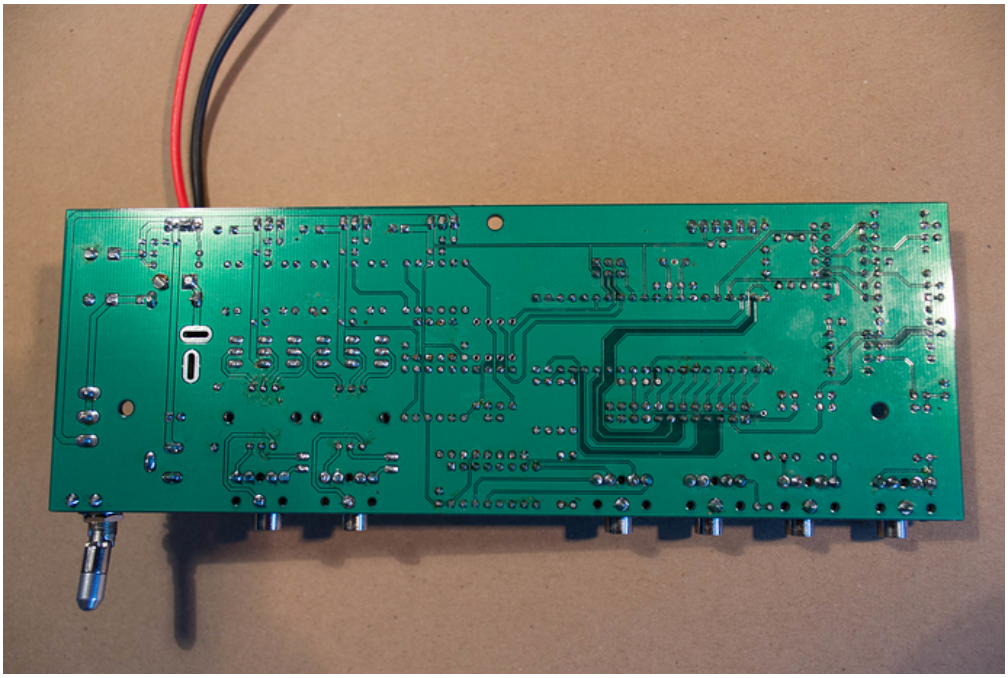
Unfortunately, I only have an old analog oscilloscope. I can provide measurements from my multimeter.
When switched on, peak battery current is 144mA, while the response time of the multimeter is 100ms.
When switched on, peak battery current is 3.77A, while the response time of the multimeter is 250µs. (charging capacitors)
The steady battery consumption after switching on is 54mA.

Pictures here:







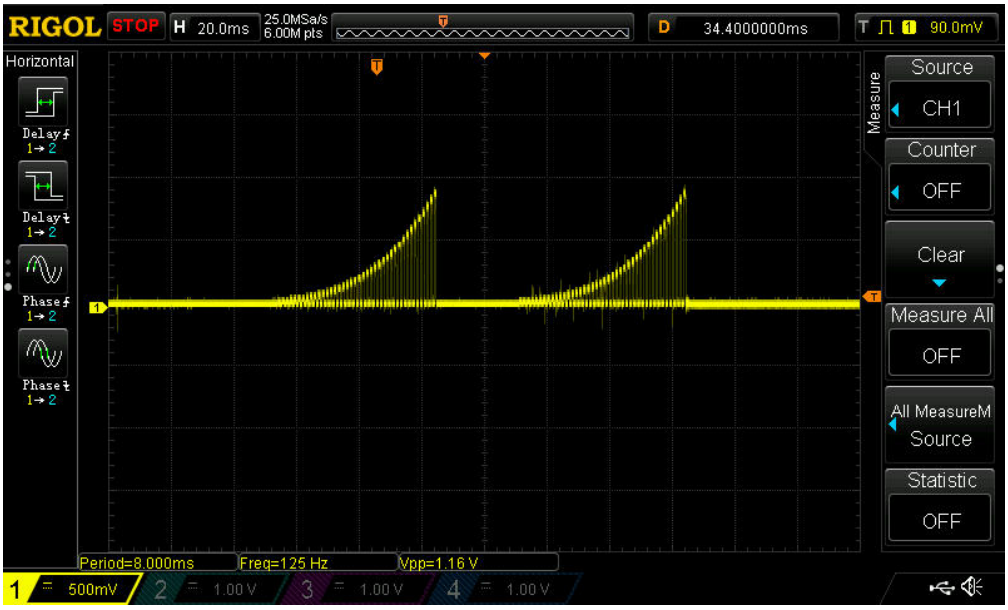


Sagittarius #4 November 14, 2018, 2:41pm

During initialisation the processor will send increasing pulses to both outputs.

These pulses cause voltage spikes across the current shunt (R30) which are measured by PA0 (pin 40).
If PA0 measures nothing or unexpected values you will see Failure 20.

The probe is connected to PA0:



What you can do with your scope is check after start up for activity on the outputs of U8, U10 and the gates of the mosfets.

1 Like

Sagittarius #5 September 22, 2018, 9:03am

Replace resistors R35 and R46 these should be 200k.

Zafphod #6 September 24, 2018, 10:37am

Yes. I'm stupid I did not notice the assembly. I took the packaging components and trusted vendors that the values on the packaging match the content.
After replacing resistors everything works as it should.
Thank you very much for all that helped me to clarify this problem.

MK312BT Failure Modes 20 and 21

Sagittarius #7 September 26, 2018, 11:56am

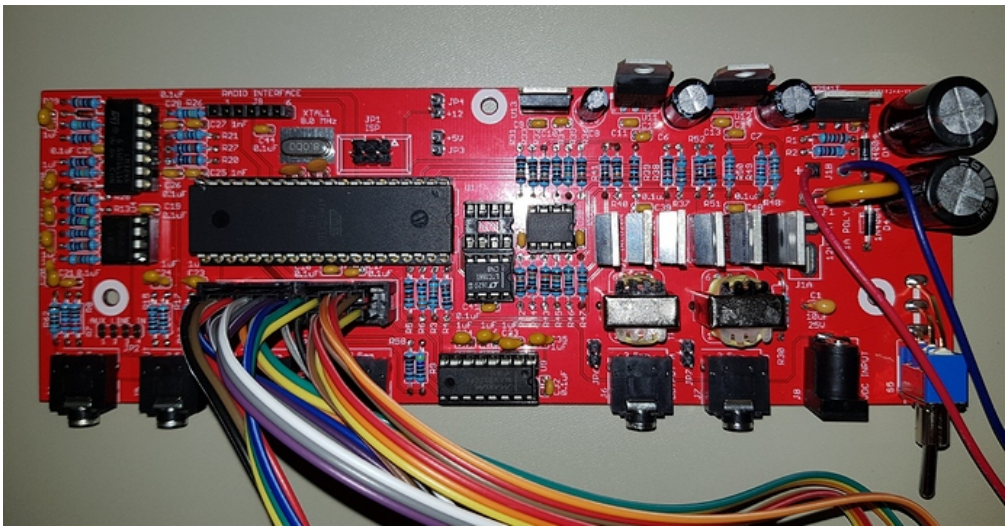
You're welcome! I'm glad that it works.

Cerb #8 March 6, 2019, 10:31pm

Hi, I'm currently also running into the failure 20 and after two evenings of trying to figure out what's causing it I'm absolut clueless.

If i mention in the bottom part that something seems to be normal to me it’s just my impression. It’s my first unit so i could be wrong and the behavior is not normal

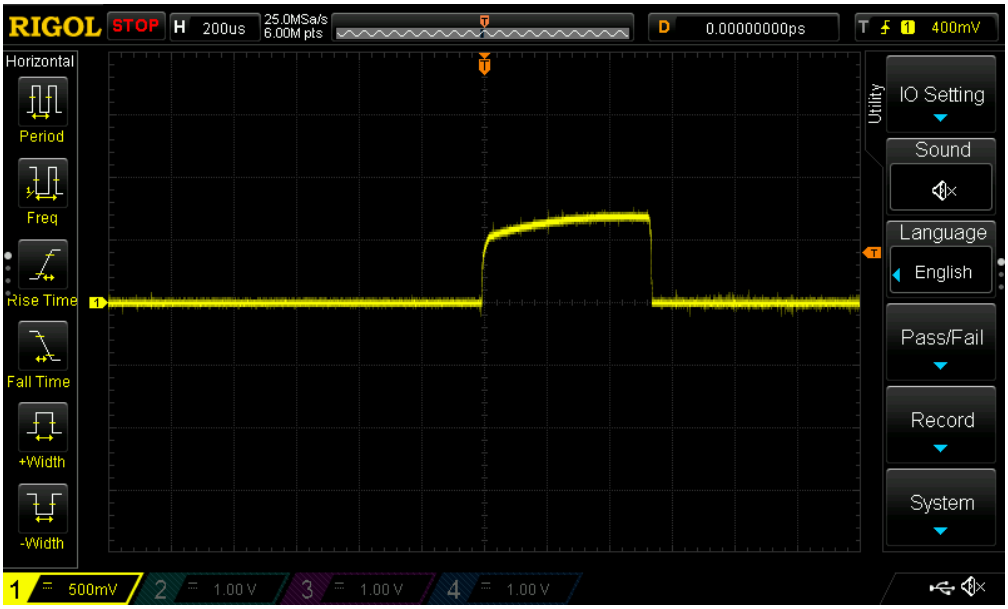
First the Board (latest 1.3): (24 pin header is the wrong way, but i fixed that with the cables)



Some things i’ve checked:

- Display and Leds work perfectly fine, but i get Failure 20
- things like low battery warnings work
- Tried it through the DC rail as well as through the battery connector
- the 5V and 12V pins on the top provide the equivalent voltage (5.1 and 11.94V)
- 7805 LDO = 5.011V
- 7809 LDOs = 8,90V
- went two times through the resistors in the Mosfet / LDO area and couldn’t find any fault.

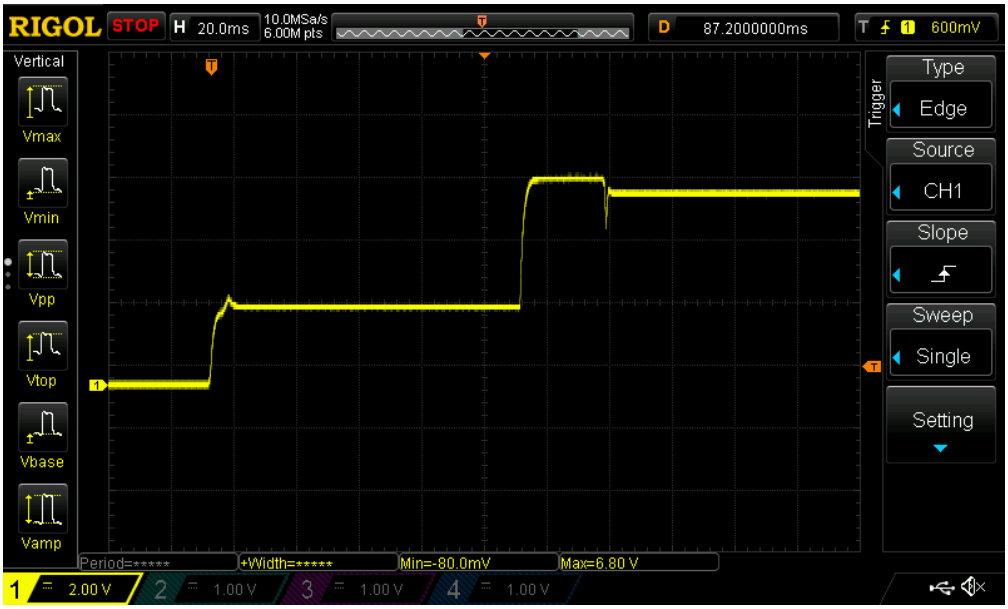
When I hooked the Scope to the PA0 Pin on the Atmega it looked much different



So next I measure the 520N and the IRF9Z24 fets. All have 8,9V at the drain pin

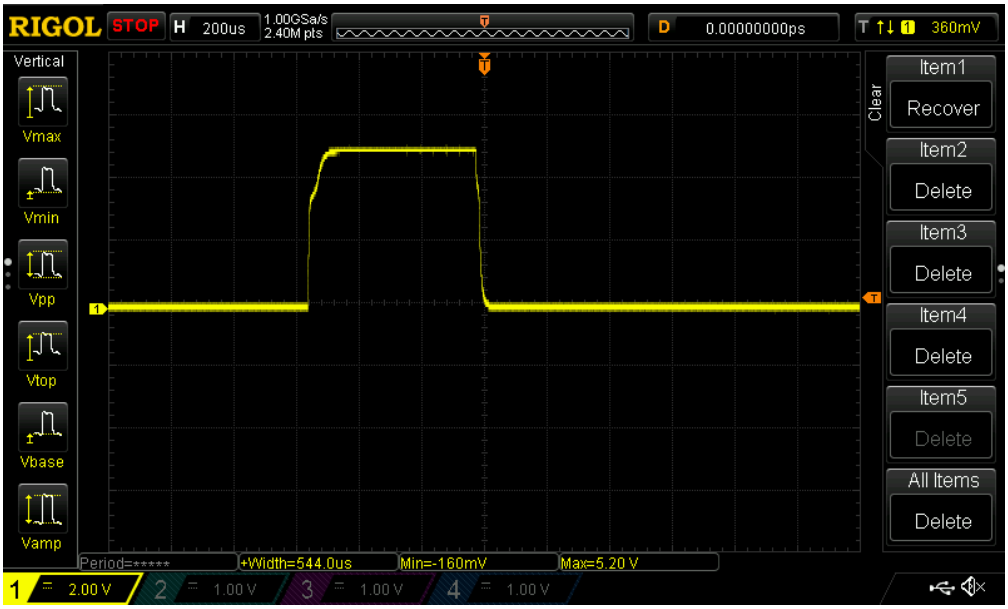
Some scrope images from the gate pins

Both IRF fets (Q3 and Q6 look normal to me. Gate ~6.1V, Drain and Source 8,9V



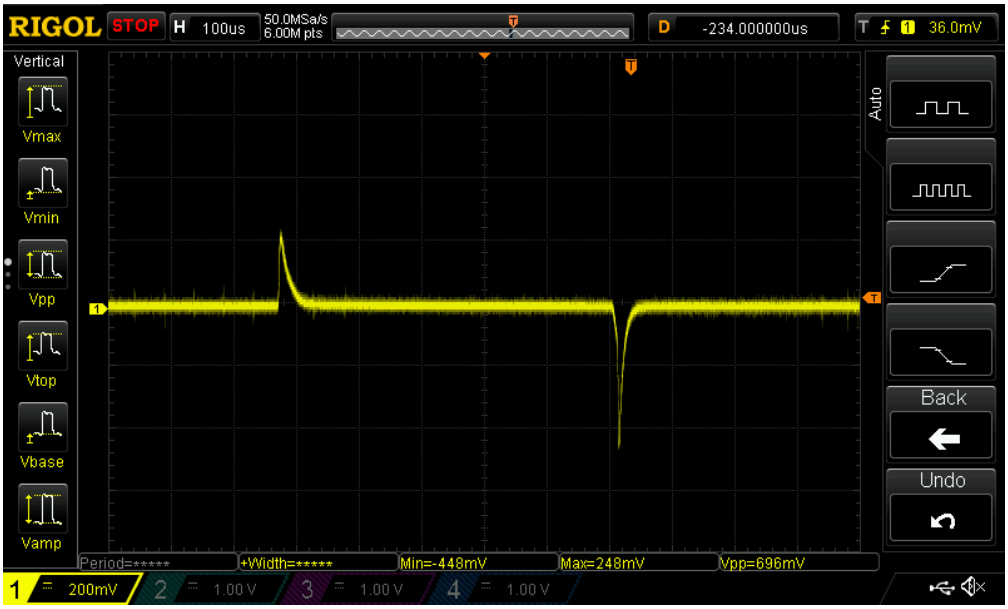
(looks similar on both so i post just one of them)

520N Q2 and Q1 (for Channel 1) seems to be also normal (?)



(again both look the same)

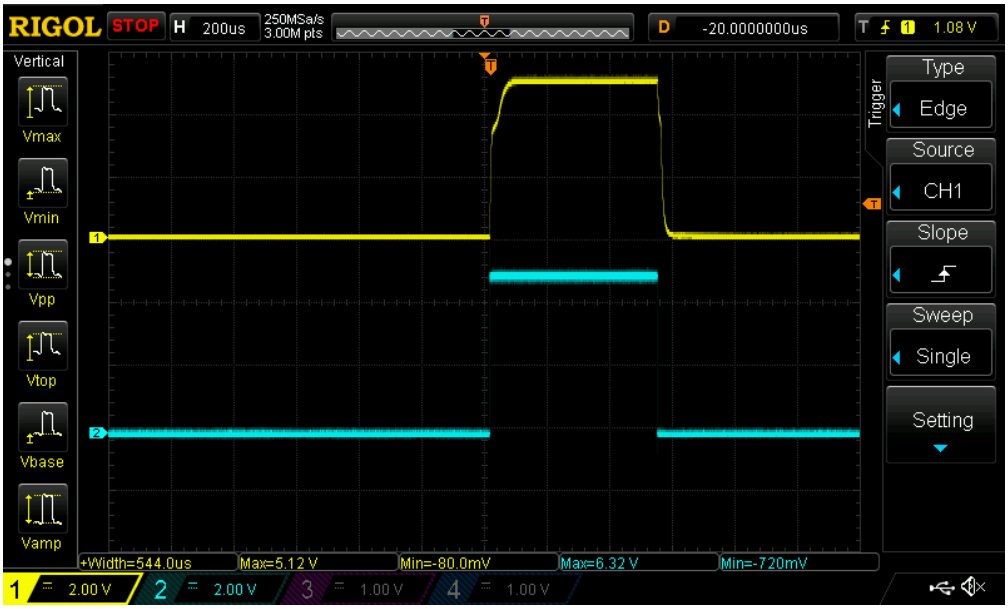
But with Q5 and Q4 (for Channel 2) my headache begins



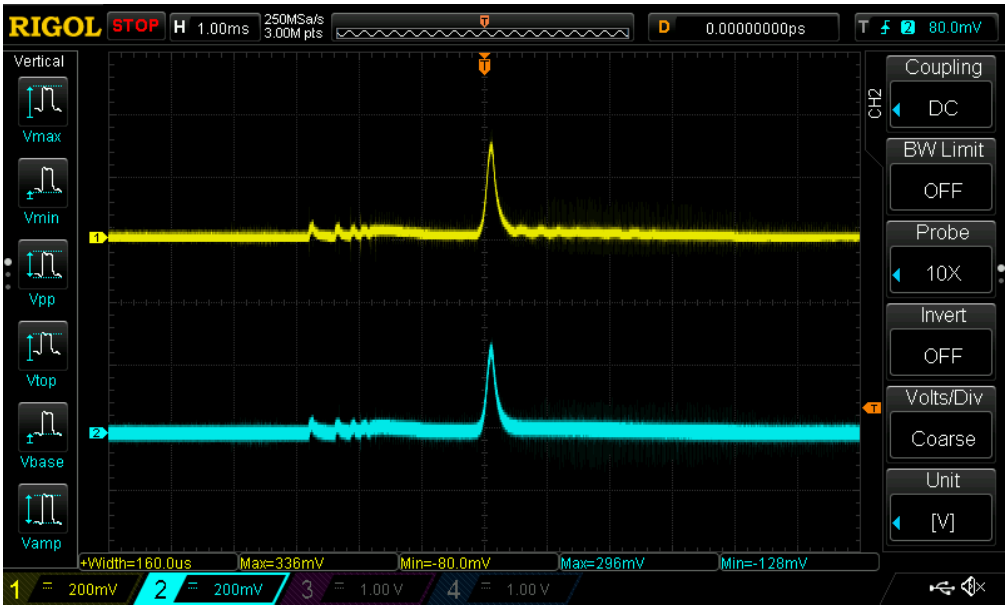
(they look both like that)

So next im measured the PB Line/Pin on the Atmega and the Gate of the 520N together

Channel A example like Q3 (yellow) and PB2 (blue)



Channel B example of Q5 (yellow) and PB1



That signal is so low and short that i'm not even sure it's a real output of the Atmega

So now I'm really confused. If Channel A works as intended (which I guess, but don't know), why don't i get any signal from PB0 and PB1 to the mosfet gates of Channel B?

Or does the software check one channel after another, so there is a problem in Channel A which i don't see so it doesn't even trigger the test on Channel B?

I hope this post didn't got too long 😃 Any help or suggestion appreciated.

MK312BT Firmware and function issues (Failure 20), debug suggestions?

bumerang #9 March 11, 2019, 11:21pm

Hi, maybe a silly idea but do you have right transformers with right secondary impedance? Do you have a correct value of current sensing resistor?

Cerb #10 March 12, 2019, 6:43pm

Hi, thanks for the reply. The transformers are the ones that were listed in the BOM list so they should be right. I've double checked the resistors and they're correct too - i'm just not sure how much tolerance the failure check routine allows?

I'm currently building a second unit and just wait tor the second set of transistors. My hope is that the second one won't get failure 20 so i've a working unit to do some A/B measurements - that would help a lot. If i should figure out what the problem was i'll update this 🙂

My cheap component tester showed a much higher Gate Threshold Voltage on the Fets than it should be. I'm not sure how accurate the readings of those component testers are, but maybe my FETs are the problem.

bumerang #11 March 12, 2019, 9:44pm

I was surprised you have right transformers because they are out of stock at Mouser - I had to use 42TU series. I am still waiting for a few components so hopefully it will work.

My component tester measures this on transistor out of the box (ESD safe box 🙂):
IRL520NPBF Vt=1,86V
IRF9Z24PBF Vt=3,58V

Cerb #12 March 21, 2019, 2:29am

I was lucky enough that someone else gave me the first set of transformer. The second set for board two I got from **ebay.co.uk**. Someone from UK is selling a few there - not the cheapest (paid like 18€ for two shipped to Germany) but better than waiting months.

My second board works now so now i can do some A/B measurements between the working and non working board. My first obversation was that i measure a difference on R34. On Both boards i measure ~5V on the top pad of the resistor, but on the bottom it's 4.1 on the working board vs 4.3/4.4V on the
non working one. If I remove the LM358N underneath i measure 3.3V on both. I've swapped the L358N but they're both fine so the issue has to be somewhere around it.

bumerang #13 March 21, 2019, 11:35pm

I finished my MK-312 today and I also get Failure 20. Incredible… i started my own topic with measurements.

Flyer13 #14 August 7, 2019, 10:15pm

Hello,
I want to share my experience.
I found the source of my failure 20:
2 DAC 1661 was installed, only 1 is necessary !
Now, 1 socket is empty, but the board is ready!
Regards
Julien

bumerang #15 August 8, 2019, 9:54pm

> Flyer13:
>
> 2 DAC 1661 was installed

how is that even possible? 😀

Flyer13 #16 August 8, 2019, 10:10pm

I put 2 LTC1661 for U8A and U8B.
Now, only U8B.
The BOM file wasn't so clear…😋(i'm french)
JR

gimlihobanka #17 April 2, 2020, 9:03am

Hello all,
I builded MK312 and flashed f005.bin firmware. Display is working and shows Failure 20. I checked all resistirs and components and Im not able find some problem.

I tryed measure signals on pins 1, 2, 3 and 4 on ATMEGA = signals to gates of mosfets and on these pins aren't signals. It looks that output to mosfets is not working. The same situation is on PA0 - signal = zerro.

Do you have some idea where can be problem? Is there some action in initialization process before tree testing pulses in startup process?

Thank you for support so much!

Michal

nestor #18 April 2, 2020, 1:41pm

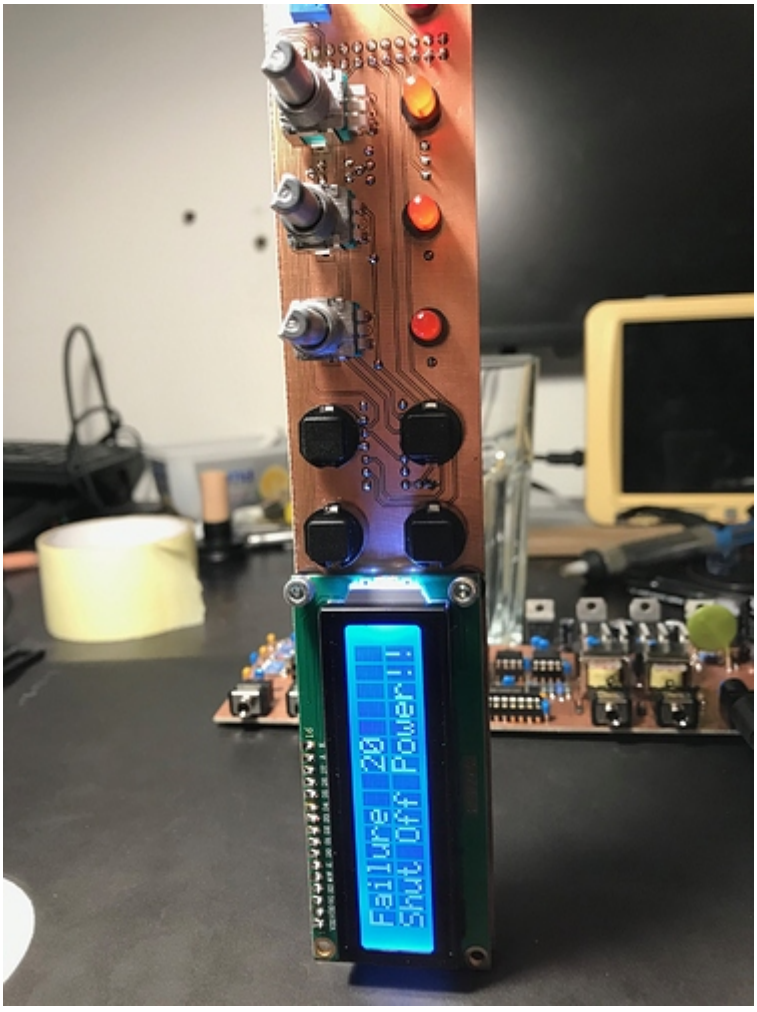
Hi,
Can you post some pictures ?
Best luck

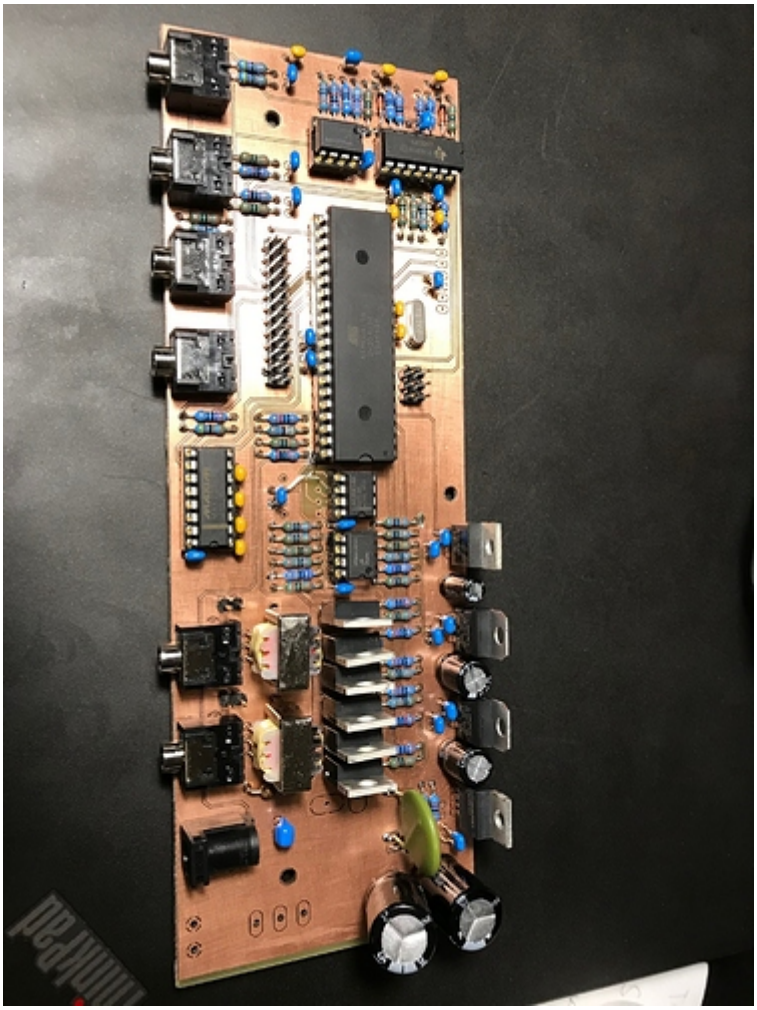
gimlihobanka #19 April 2, 2020, 5:43pm

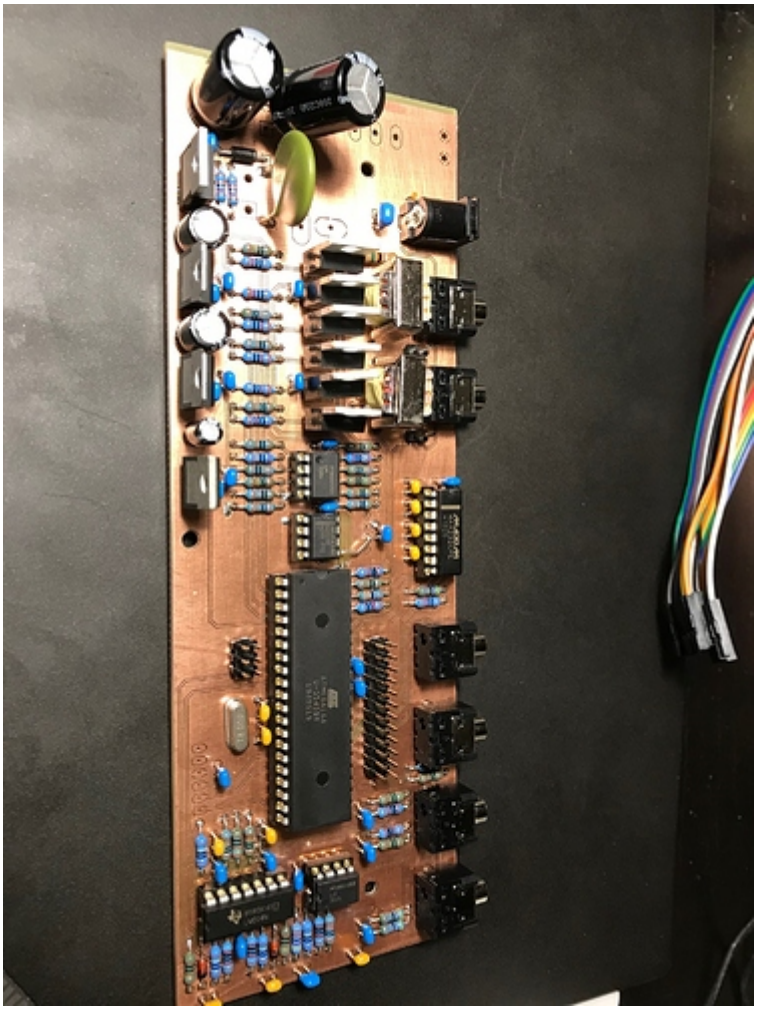
Hi Nestor, pictures are below. My PCB is homemade = no professional production but I checked all connections and parts and looks OK. When I switch it ON, I have error Failure 20 and on PA0 pin is not visible signal with tree test pulses - nothint. I checked output from ATMEGA and LM359 to

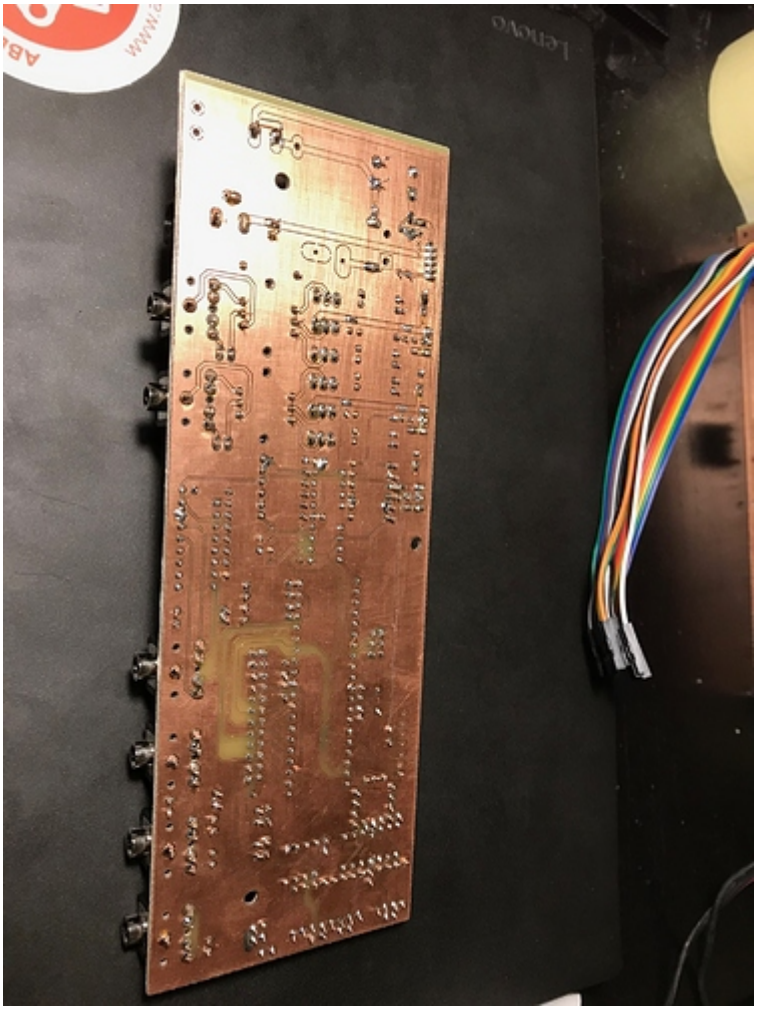
MOSFETS and nothink - no signal after switcing on. All voltages from regulator OK, only on output of LM2941 in 14 volts and not 12. I tested it with 12V on batery input with the same result.
Display is showing message, but backlight is blinking in interval around 10 seconds = Short backlight ON and than 10 second without backlight. The same situation with blinking is on LED Output A and Output B.

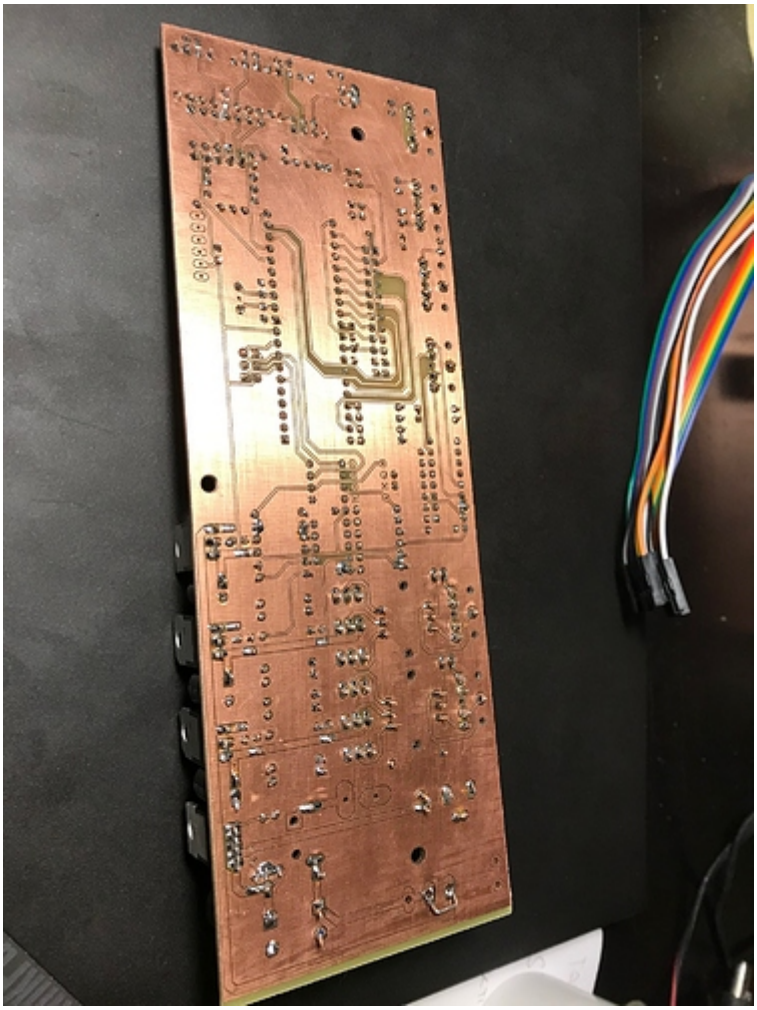
I tryed firmware f005.bin and t002_bootloader.bin

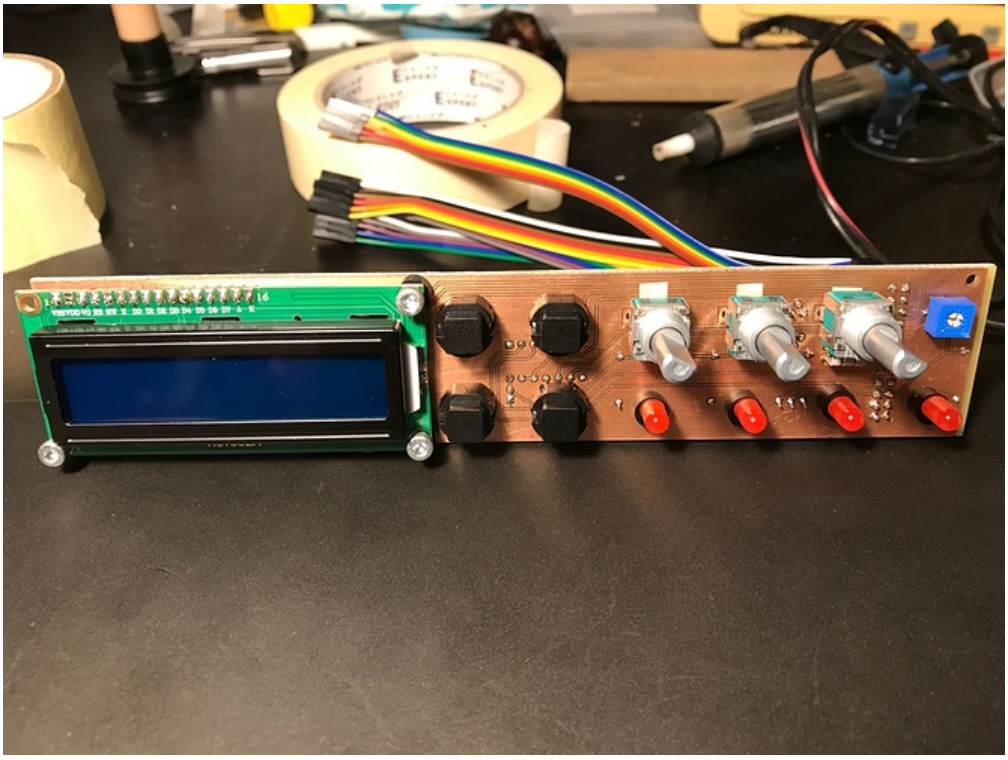

Failure 20
Shut Off Power!!!

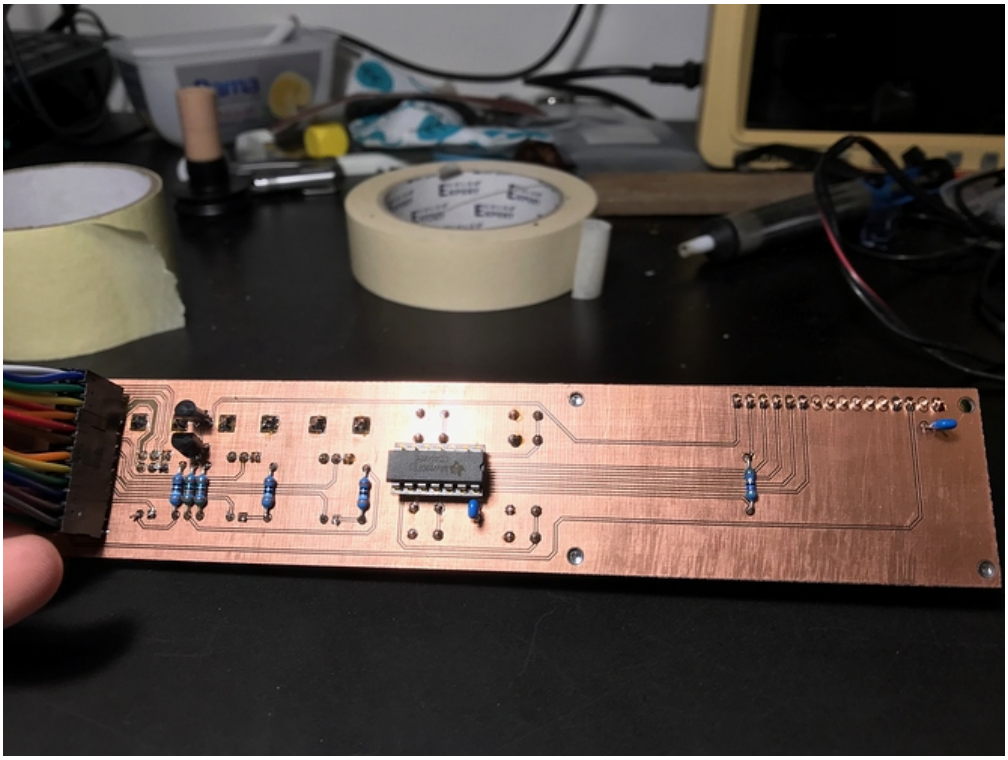












bumerang #20 April 3, 2020, 1:17am

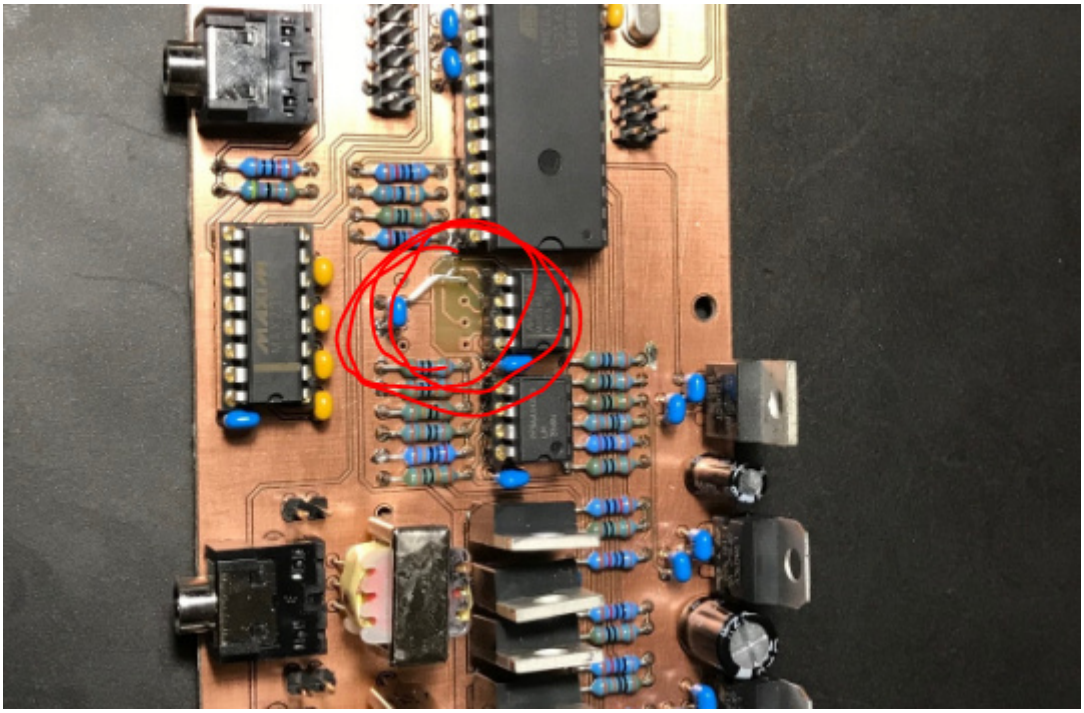
What is the exact type of the P-channel FETs you use?

gimlihobanka #21 April 3, 2020, 6:37am

Hello, P FETs are IRF9Z24N, N are IRL520N. All components from Mouser based on buttshock list of parts.

bumerang #22 April 4, 2020, 1:33pm

You use a wrong DAC. With the current firmware you should use the LTC part not the MAXIM.



gimlihobanka #23 April 4, 2020, 7:21pm

Hi, thank you for information, I will order LTC and chack it!

nestor #24 April 8, 2020, 3:07pm

Hello,
I hope your device work now !
Nice work with the homemade PCB, is that made with a CNC ?

cheers =)

gimlihobanka #25 April 14, 2020, 7:18pm

Hi, it is wotking with LTC - thank you for information. PCB is made by UV light and film with drawing, Im happy that it is working. Im not sure if output power is OK now, but I need check manual and learn how to setup box and how is it working 🙂

Scipio #26 May 4, 2020, 7:15pm

Glad I am not the only one with this issue. And thanks for all the useful information above. I fitted the maxim chip but seems like I need the LTC1661 instead, so off shopping 🙂