SUPPLEMENTARY INFORMATION

Schematics, bill of materials, notes on PCB impression and on the first use.

SOMA

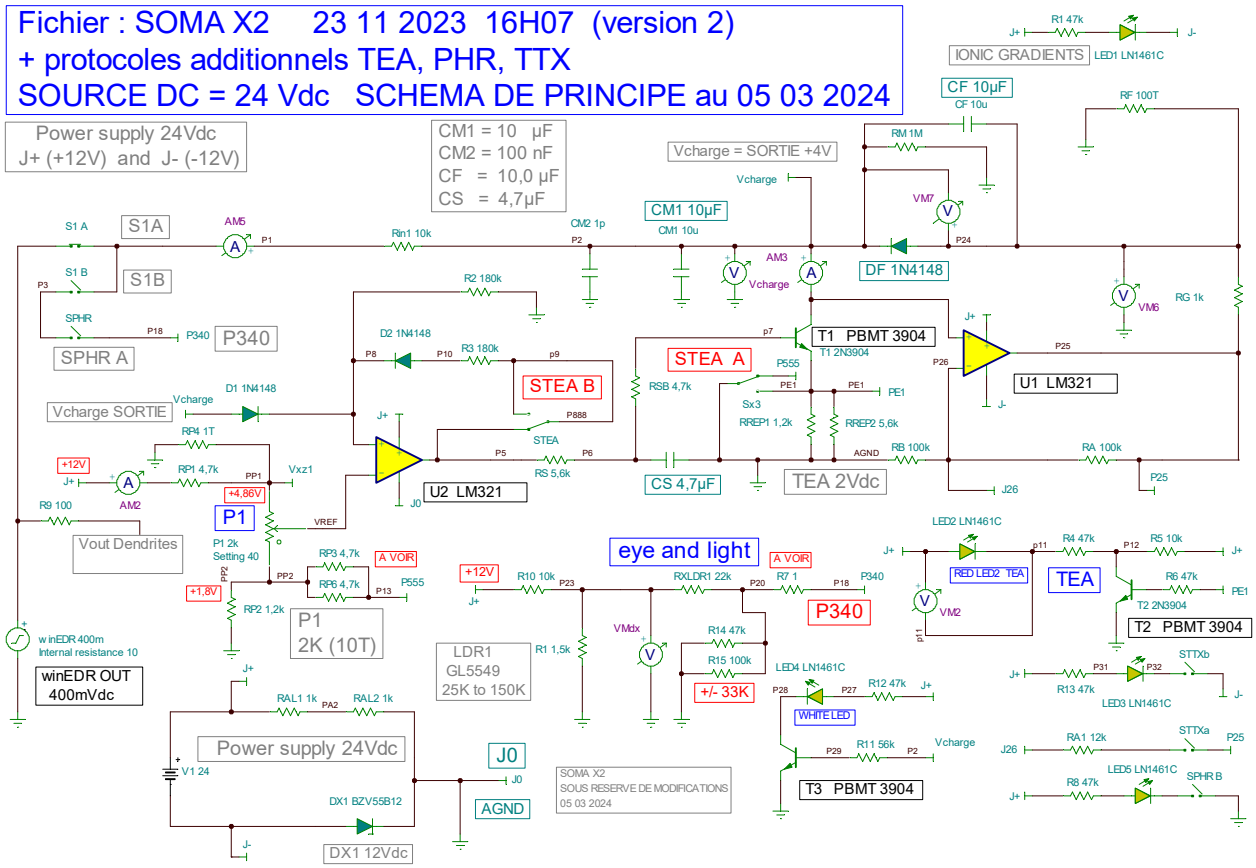

Figure 1. Schematics for SPICE simulation and practical realisation.

Notes : The switches are DPDT (A et B). RF is a resistance that evetually allows measuring commande current to the output Vcharge (its value is 100k). This resistance is not necessary in practical realisation. The practical realisation of the PCB uses a mix of SMD and traditional components for better stability.

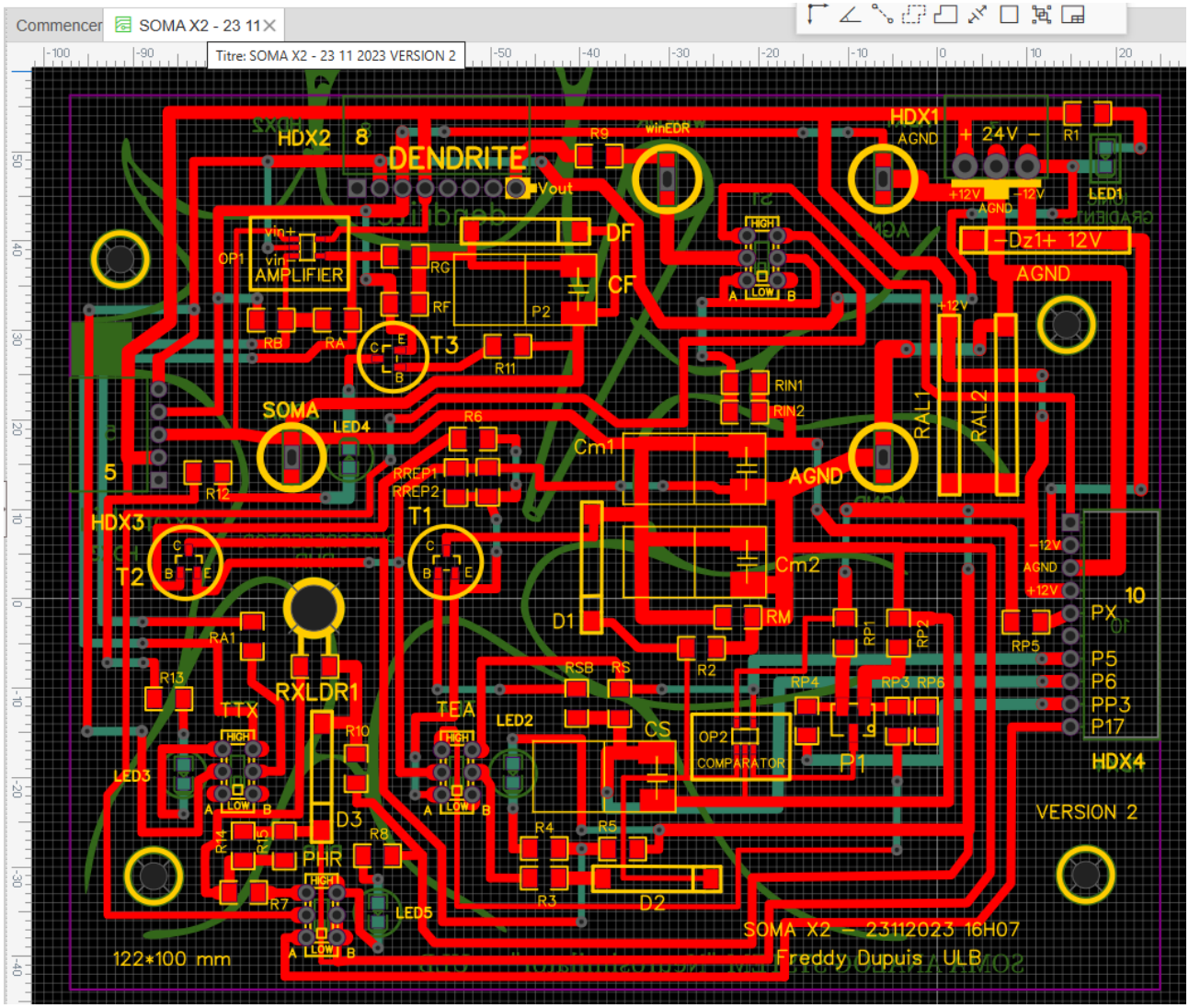

Figure 2. View of PCB card (components side).

List of SOMA components (with LCSC.com references) :

Cm1 = 10µF (Cm1 ≥ CF) C162684 C531341 50Vdc 25Vdc
CF = 10µF C162684 C531341
CS = 4,7µF C2839238 C3696971 50Vdc 25Vdc
RSB = 4k7 C144486
RS = 5K6 C229724
RF = — (Not used)
Rin1 = 10K C140407
Rm = 1M C108083
Rg = 1K C102060
RA = RB = 100K C144522
RS = 5K6 C229724
RP1 = 4k7 C144486
RP2 = 1k2 C212484
RP4 = — (not used)
P1 = 2K (multiturn potentiometer) C116322
R7 = 0 (short-circuit)
R10 = 10K C140407
D3 is replaced with résistance RD = 1K5
R14//R15 = (47k//100k) ±33K (to be adjusted) C144490 // C144522
RP3//RP6 = ± 1K5 (adjustment of the peak voltage with TEA to +4Vdc) C114929
RREP1//RREP2 = 1K5//2K7 (adjustment of the plateau voltage with TEA to +2Vdc) C114929 // C104725
D1 = D2 = DF = 1N4148
R2 = R3 = 180K C104659
R4 =47K C102201
R5 = 10K C140407
R6 = 47K C102201
R13 = 47K C102201
RA1 = 12K C171051
RAL1 et RAL2 = 1K C173143
R1 = 47K C102201
DF, D1, D2 = 1N4148 C402212
LDR = (100K à 200K), P=3mm C125631
U1 et U2 = LM321TR C2842352
TR1 à TR3 = 2N3904 C8667
DZ1 = 12Vdc C388130
Contact pins = RH-5011 C5199814
Male connector HDX1 3P (Power 24Vdc) C441172 KF2EDGR-3.5-3P
Female connector HDX2 8P (DENDRITE) C2897390
Female connector HDX3 5P (Axon Hill) C35167
Female connector HDX4 10P (extension cards) C2932683
1 WHITE LED C965818
1 BLUE LED C84259
3 RED LEDs C965812
SWITCH double-inverter = C189615

NODE OF RANVIER

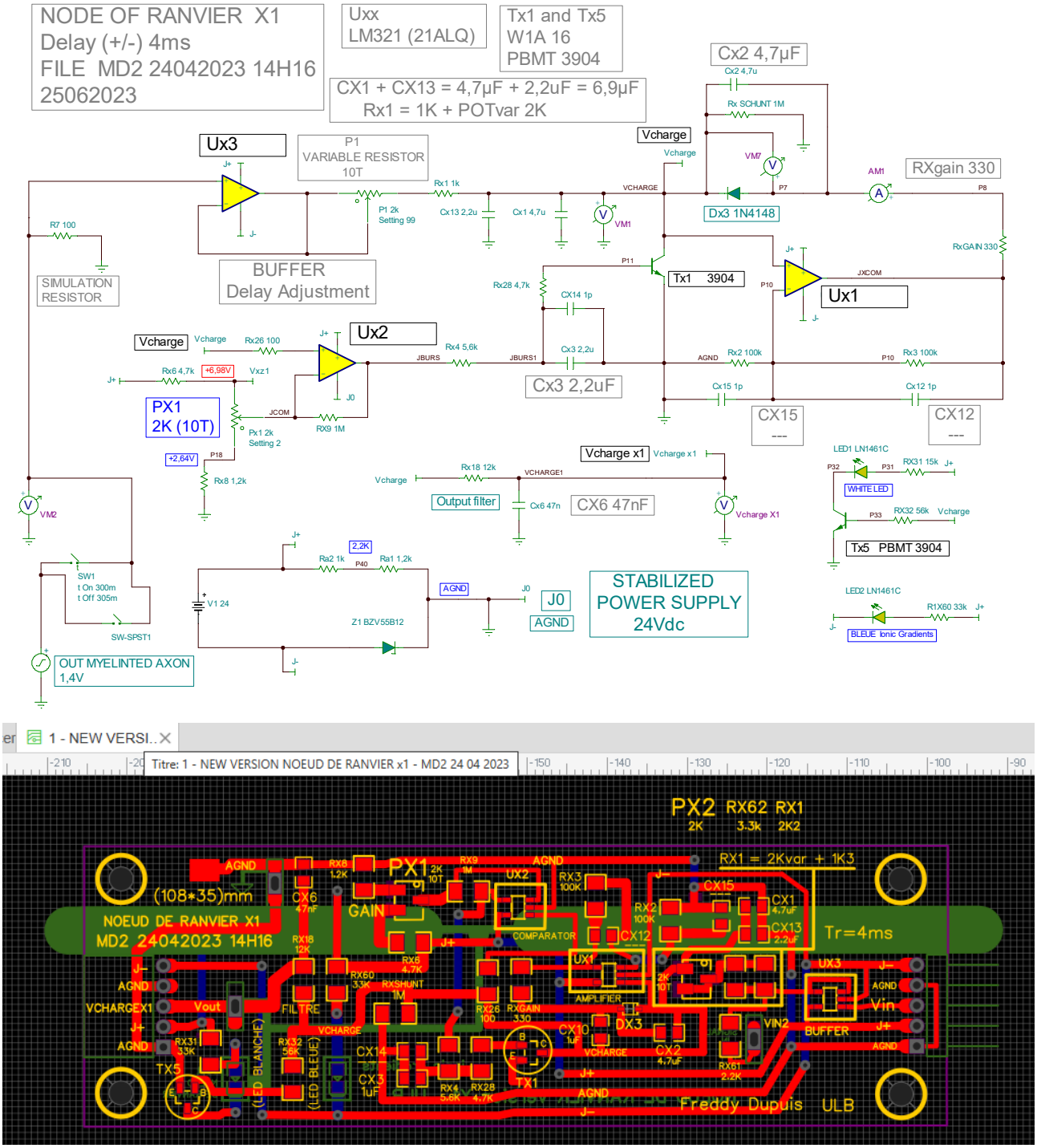

Figure 3. Schematics and PCB view (components side) of Ranvier's node. The principal schema is identical to soma, but the values of components are different.

List of Nove of Ranvier components (with LCSC.com references) :

CX1=4,7µF // CX13 =2,2µF = 6,9µF ceramic	C162274 // C237392
CX2=4,7µF	C162274
CX6 = 47nF	C107154
RX4=5,6K	C229724
RX9 = 1M	C108083
RX8 = 1K2	C212484
RX6 = 4K7	C144486
RX26 = 100	C245445
RX28 = 4K7	C144486
RX2 = RX3 = 100K	C144522
RX1 = 1K + PX2 (regulation of signal delay)	C102060 + C116322
RXSHUNT = 1M	C108083
RX60 = 33K	C137309
RX61 = 2k2	C114933
RX32 = 56k	C137251
RX18 = 12K	C171051
RX31 = 33K	C137309
RXgain = 330	C17930
PX1 and PX2 = 2K (multi-turn potentiometers)	C116322
TR1 et TR5 = 2N3904	C8667
UX1 à UX3 = LM321tr	C2842352
1 WHITE LED (Signal)	C965818
1 BLUE LED (Ionic Gradients)	C84259
Contact pins	C5199814
Female connector 5P (output)	C35167
Male connector 5P (input)	C138801

The following components on the PCB card are not used
CX12 = ---
CX15 = ---
CX14 = ---
CX10 = ---
CX5 = ---
CX3 = — (in // to CX2)

DENDRITES

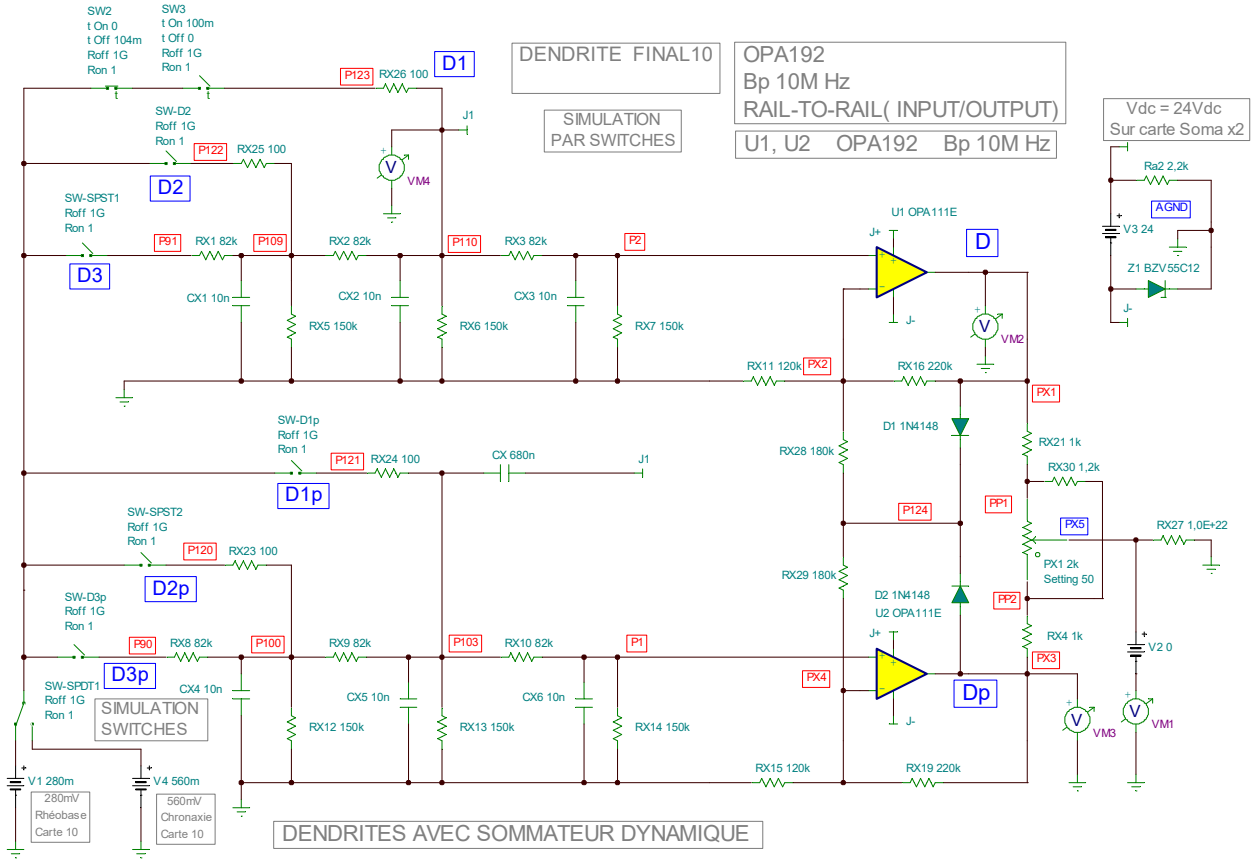

Figure 4. Schematics of dendrites

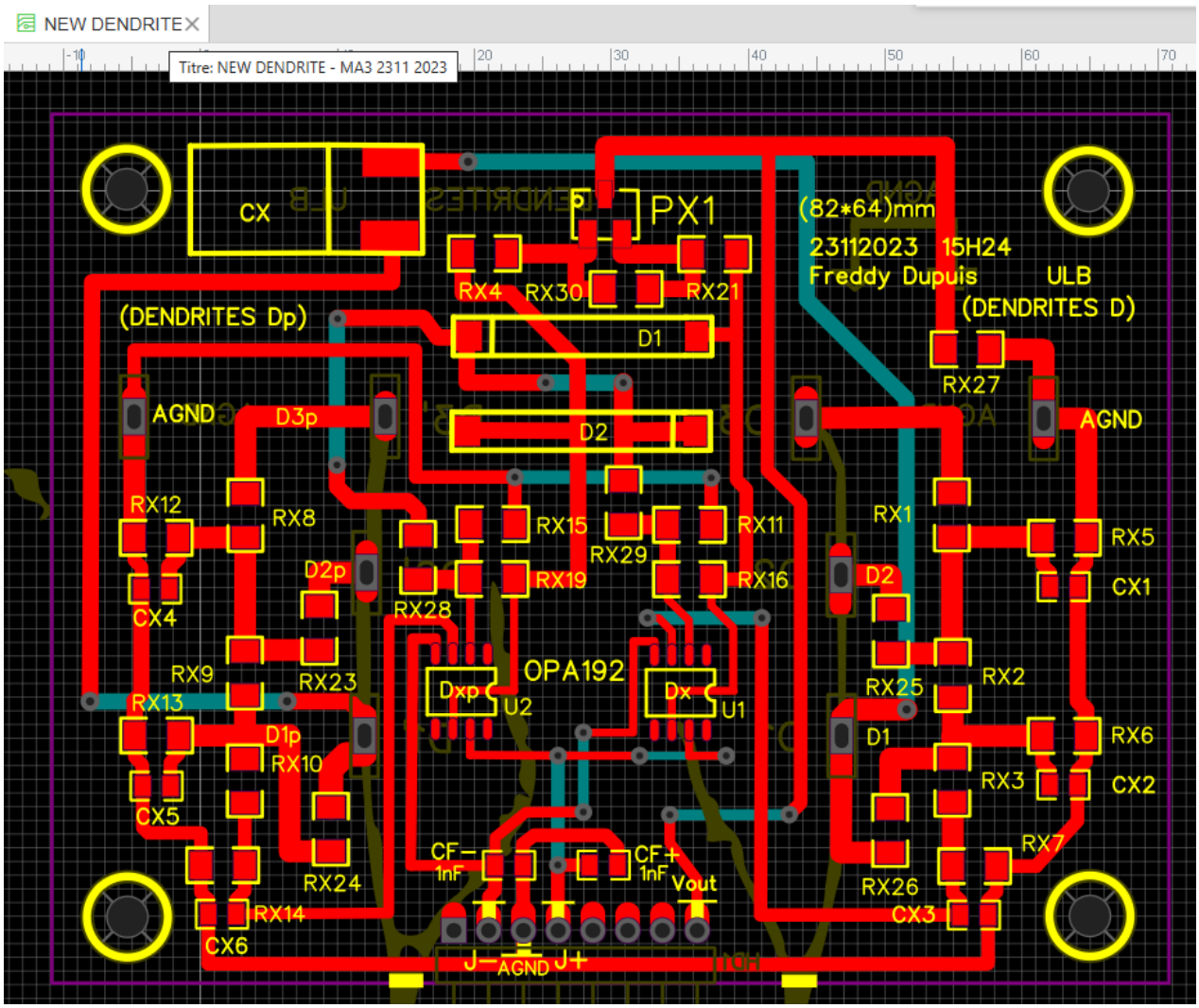

Figure 5. View of PCB card of dendrites (components side).

List of dendrites components (with LCSC.com references):

PX1 = 2k (multi-turn potentiometer)		C116322
RX30 = 1K2		C17891
RX27 = —		
RX1, RX8 = 82K	C17979	C17979
RX2, RX9 = 82K	C17979	C17979
RX3, RX10 = 82K	C17979	C17979
RX5, RX12 = 150K	C2907431	C114931
RX6, RX13 = 150K	C2907431	C114931
RX7, RX14 = 150K	C2907431	C114931
RX25, RX23 = 100		C245445
RX26, RX24 = 100		C245445
CX1, CX4 = 10nF		C77053
CX2, CX5 = 10nF		C77053
CX3, CX6 = 10nF		C77053
RX21 = 1k		C2907372 C102060
RX4 = 1k		C2907372 C102060
RX11, RX15 = 120K		C163387
RX16, RX19 = 220K		C130275
RX28 = 180K		C137381
RX29 = 180K		C137381
D1 = 1N4148		C402212
D2 = 1N4148		C402212
CF = 1nF		C46553
U1, U2 = OPA192		C2861286
alternatively TLV07		C190218
CX = 680nF P=5mm Polyester Film Capacitor		C280298
Contact pins		C5199814
Male connector 8P (output) =		C225494

MYELINATED AXON

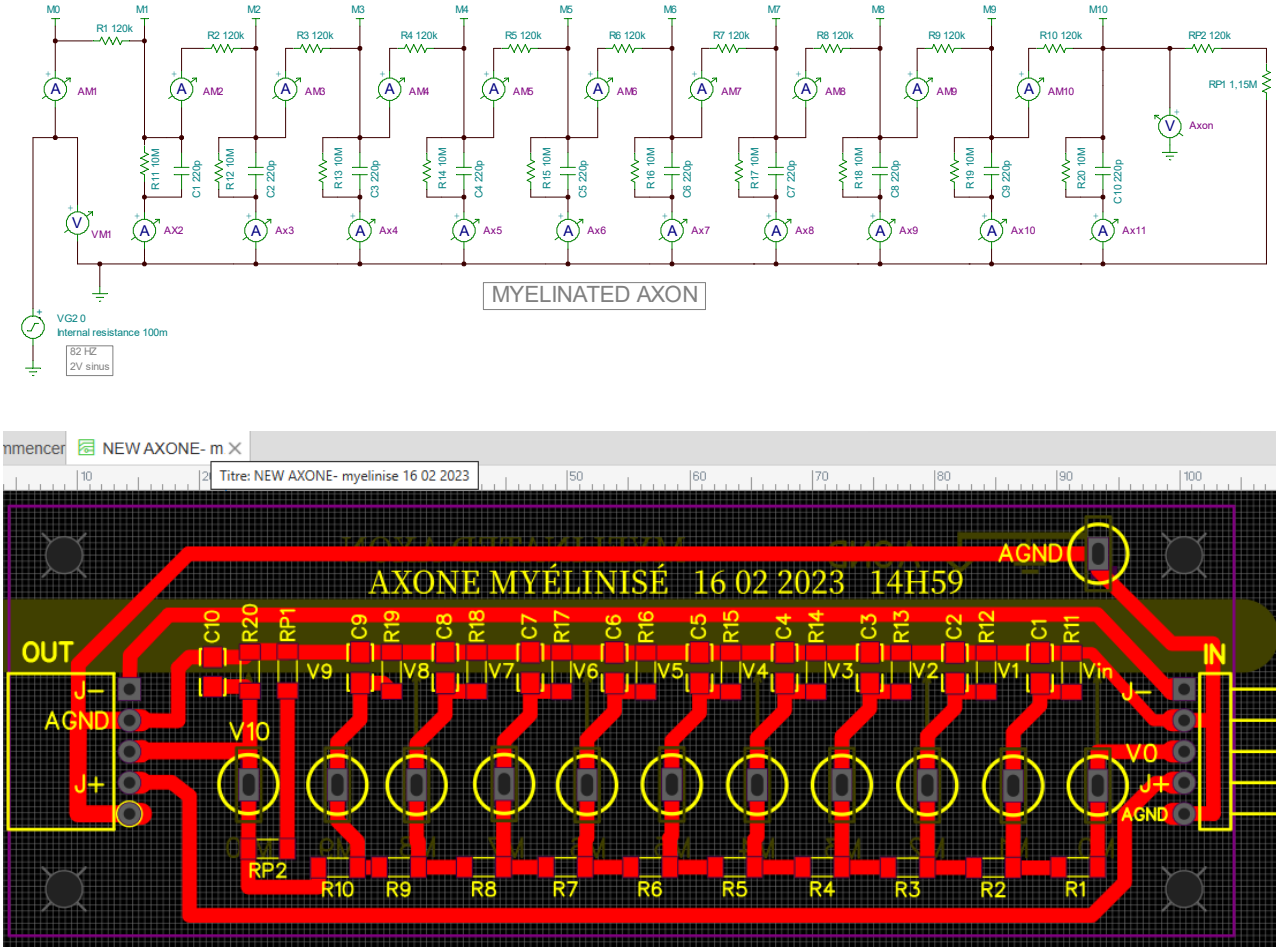

Figure 6. Schematics and PCB view (components side) of myelinated axon.

List of components of myelinated axon (with LCSC.com references):

R1 to R10 = 120K	C163387
R11 to R20 = 10M	C275643
RP1 = 1M15	C368017
RP2 = 120K	C163387
C1 to C10 = 220pF	C107081
Contact pins	C5199814
Female connector 5P (output)	C35167
Male connector 5P (input)	C138801

DEMYELINATED AXON

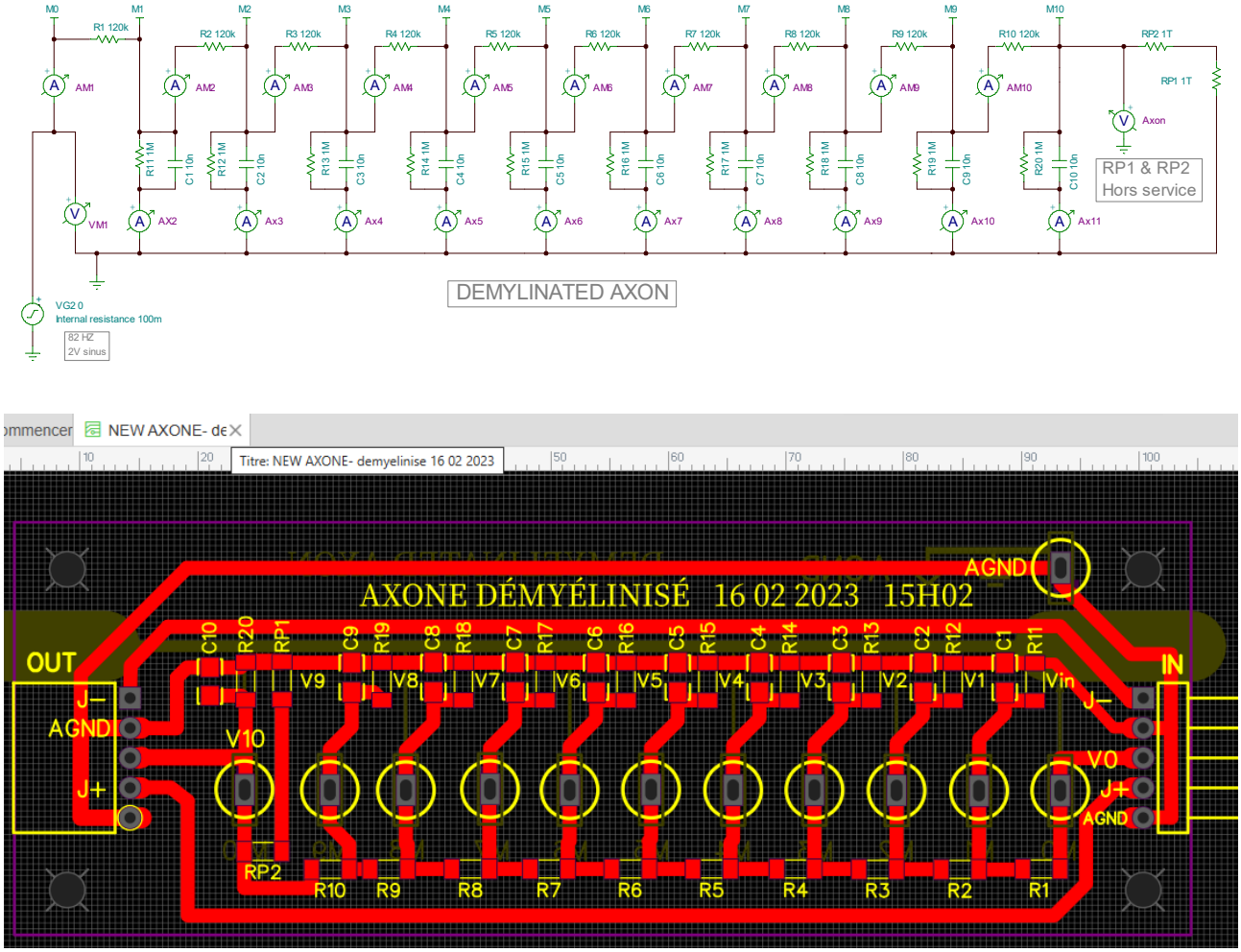

Figure 7. Schematics and PCB view (components side) of demyelinated axon.

List of components of myelinated axon (with LCSC.com references):

R1 to R10 = 120K	C163387
R11 to R20 = 1M	C108083
RP1 = not used	
RP2 = not used	
C1 to C10 = 10nF	C1589
Contact pins	C5199814
Female connector 5P (output)	C35167
Male connector 5P (input)	C138801

Important notes :

1. We suggest creating GERBER files immeadiately prior to PCB impression by importing the attached JSON files to EasyEDA.com. This allows also eventual modifications if needed.

2. Initially, the switches S1, TEA, PHR, TTX are in the LOW position and no predefined stimulation protocols are applied – the stimulation signal enters directly to the pin of the pipette on the SOMA PCB.

3. When the S1-switch is in HIGH position, the stimulation signal is deviated to the HDX4 connector. This allows stimulating the SOMA with another protocol via auxiliary PCB connected to HDX4. Attention: In the absence of this auxiliary PCB and with the switch S1 in HIGH position, the entry of the SOMA is at high impedance.

4. When S1 and PHR switches are in HIGH position, the pipette pin on SOMA PCB is disconnected. Instead, photoresistance (LDR, photoreceptor) becomes engaged. This allows observation of oscillatory behavior of SOMA under different illumination conditions.

5. S1 in LOW position and TTX in HIGH position, only passive responses of the SOMA are possible.

6. All switches in LOW position and with a subthreshold stimulus applied to the pipette – only passive response is observable.

7. PCB card of dendrites is connected to HDX2 socket. (for temporal and spatial summation experiments)

8. PCB cards of axones are connected to HDX3 socket. Node of Ranvier is connected in cascade to the axon.

9. The pin of output of the SOMA is referenced to AGND.