

TETRODE BOARD GRID 1 SHUNT REGULATED SUPPLY

Calculation of R12, R18 & blocking voltage Zeners current

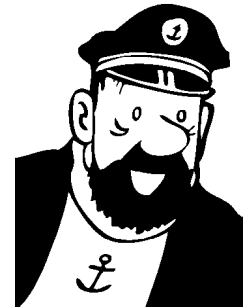
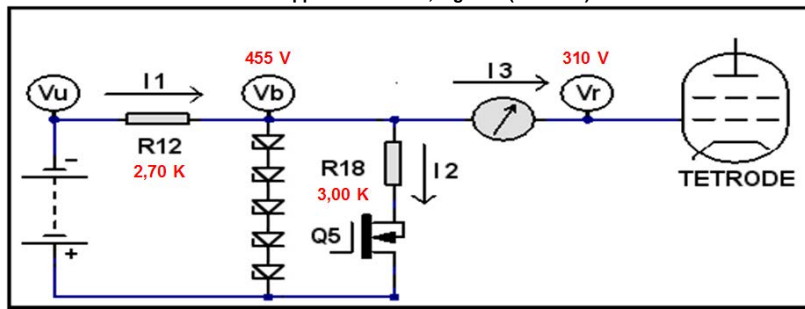
This spreadsheet follows the method described in Application Note 3 © 2003 IFW Technical Services Version 1.0 7 March 2003 by GM3SEK

Modification for F1FRV G1 board Revision 7, with power P MOSFET and Zeners for G1 blocking voltage

http://f1frv.free.fr/main1a_Tetrode_Linear_Amp.html

Application Note 3, Figure 2 (modified)

Rev 0 January 2022



Step

- 1 Enter unregulated input voltage: **Vu = 540 V** at load ~ **85 mA**
Estimated transformer voltage before rectifiers & filter: **400 V AC**
- 2 Enter G1 BLOCKING voltage: **Vb = 455 V** **91 V** for each Zener
Blocking voltage Vb Zeners current: **31 mA**

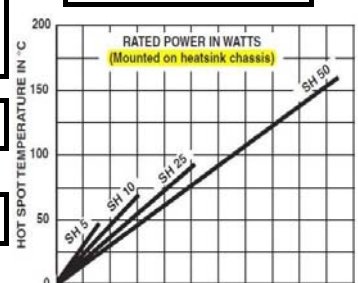


- 3 Enter regulated output voltage: **Vr = 310 V**
- 4 Enter maximum grid current: **I3 = 50 mA**

Values in Figure 2

I1 = 85 mA
I2 = 85 mA
I3 = 50 mA

R12 & R18



- 5 Resistor R12: Use next standard value below **2,90 k**
Enter value used for R12: **R12 = 2,70 k**
Power dissipation of R12 **20 W @ I1 = 85 mA**
- 6 Resistor R18: Use next standard value below **3,64 k**
Enter value used for R18: **R18 = 3,00 k**
Maximum power dissipation of R18 = **27 W @ I2 = 85 mA**

2,7 kOhms	R12
50 W	
3 x 1 kOhms	R18
25 W	

MAXIMUM VDS voltage of Q5 (for Q5 selection) = **205 V @ I2 = 85 mA**
MAXIMUM current of Q5 (for Q5 selection) = **85 mA @ VDS = 58 V**
MAXIMUM power dissipation of Q5 (for Q5 selection) = **9 W**

Q5 reference (see datasheet) **FQP3P50** Q5 Power **85 W @ 25°C**
Q5 MAXIMUM Power @ Junction Temperature **56,69 W** Q5 Derating **0,68 W / °C**

Heatsink thermal resistance **2,40 °C/W**
Q5 Junction to Case **1,47 °C/W** (see datasheet)
Insulating pad Rth **0,20 °C/W**
Ambient Temperature: **30 °C**
Q5 Junction Temperature: **67 °C**

SELECT RESISTORS MAX DISSIPATION AT LEAST 2 OR 3 x USED POWER DISSIPATION. SEE TEMP VS POWER CURVE, RESISTORS CAN BE PARALLELED TO OBTAIN THE DESIRED VALUE (EG. 3 x 3,3 K 50 W IN // TO HAVE 1,1 K 150 W) RESISTORS CAN BE SERIALISED TO OBTAIN THE DESIRED VALUE (EG. 2 x 470 50 W in SERIE TO HAVE 0,94 K 100 W)

DESIGN CHECK

EXCEPT IF YOU ARE SURE OF INPUT VOLTAGE STABILITY AT I1 CURRENT, AND NETWORK MINIMUM VOLTAGE.

Go back to **Step 2** now, and try a 5% lower value for Vb. In cell E26, enter **432 V**

Do you see any red error messages?

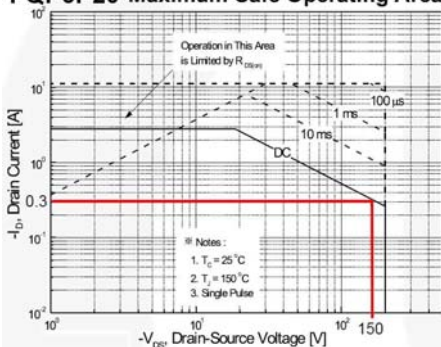
If you see any red error messages, your present resistors values are marginal !

You should reduce the indicated resistor values, and / or increase the transformer voltage, until **NO** error messages appear when you decrease Vb by 5% from your expected minimum value at maximum current. **EXCEPT IF YOU ARE SURE OF INPUT VOLTAGE STABILITY AT I1 CURRENT, AND NETWORK MINIMUM VOLTAGE.**

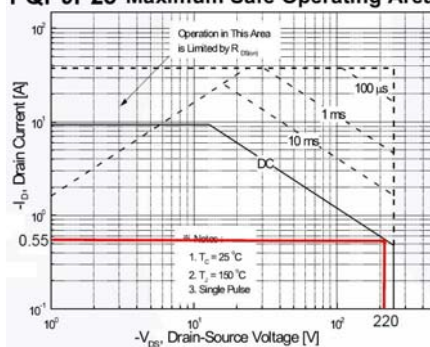
ZENERS 5 WATTS 1N53xxB

16 V MAX CURRENT 295 mA
24 V MAX CURRENT 198 mA
27 V MAX CURRENT 176 mA
36 V MAX CURRENT 132 mA
43 V MAX CURRENT 110 mA
47 V MAX CURRENT 100 mA
51 V MAX CURRENT 93 mA
75 V MAX CURRENT 63 mA
91 V MAX CURRENT 52 mA
100 V MAX CURRENT 47 mA
150 V MAX CURRENT 31 mA
200 V MAX CURRENT 23 mA

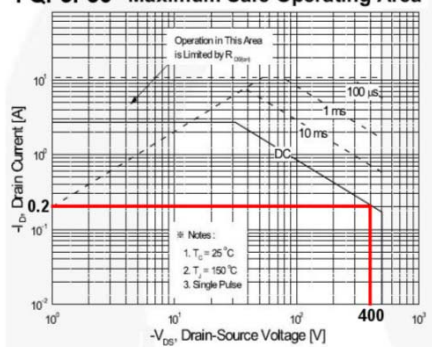
FQP3P20 Maximum Safe Operating Area



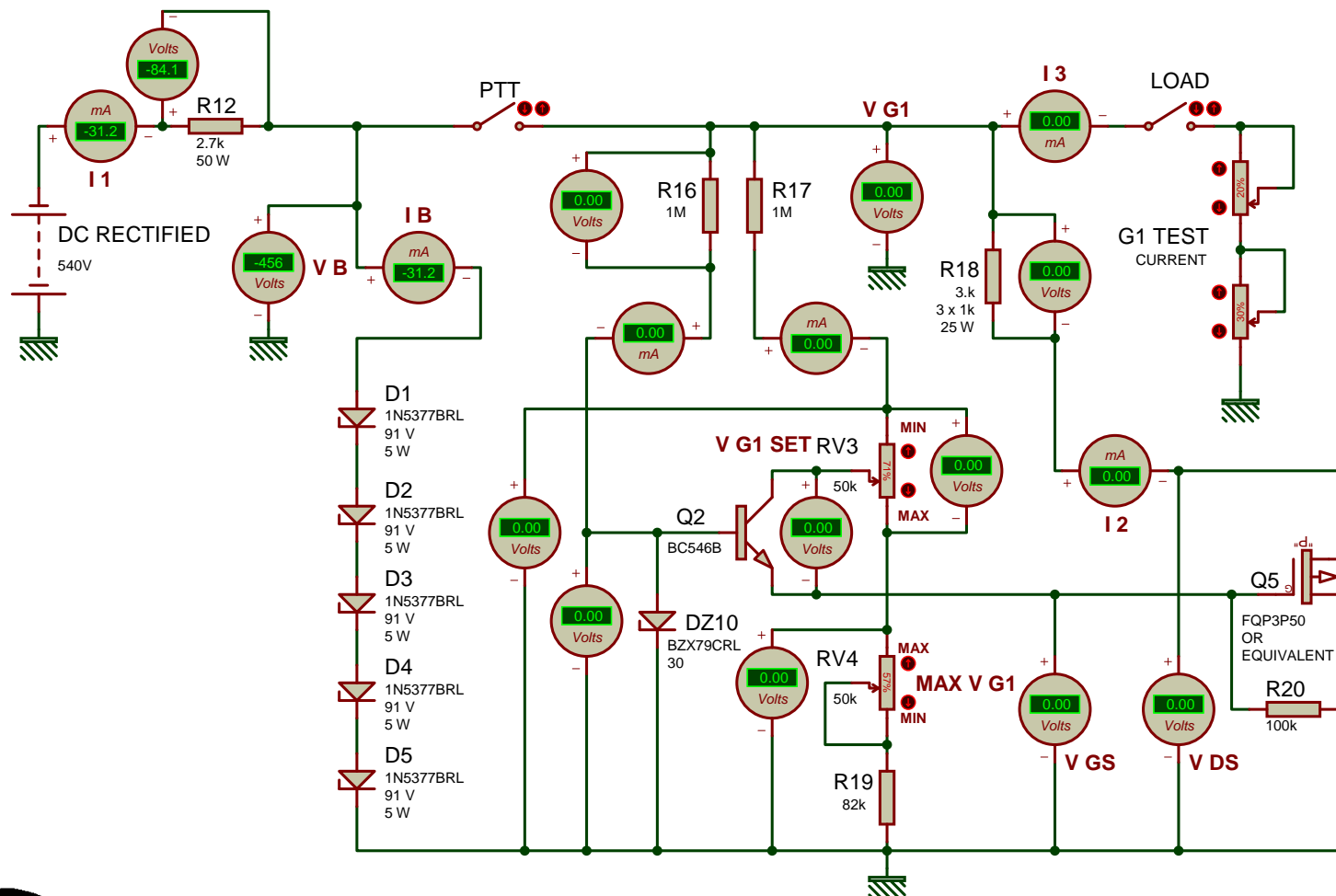
FQP9P25 Maximum Safe Operating Area



FQP3P50 Maximum Safe Operating Area



NOTES If the simulation aborts with "timestep too small" then set : RELTOL=0.005 (up to 0.01) , ITL4=300 (up to 500) , ITL1=300
And in extreme cases (in order of importance) : GMIN=1e-09 , ABSTOL=1e-08 , VNTOL=1e-05 (up to 1e-03) only if required TMAX=10 t



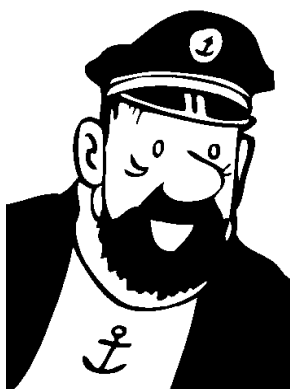
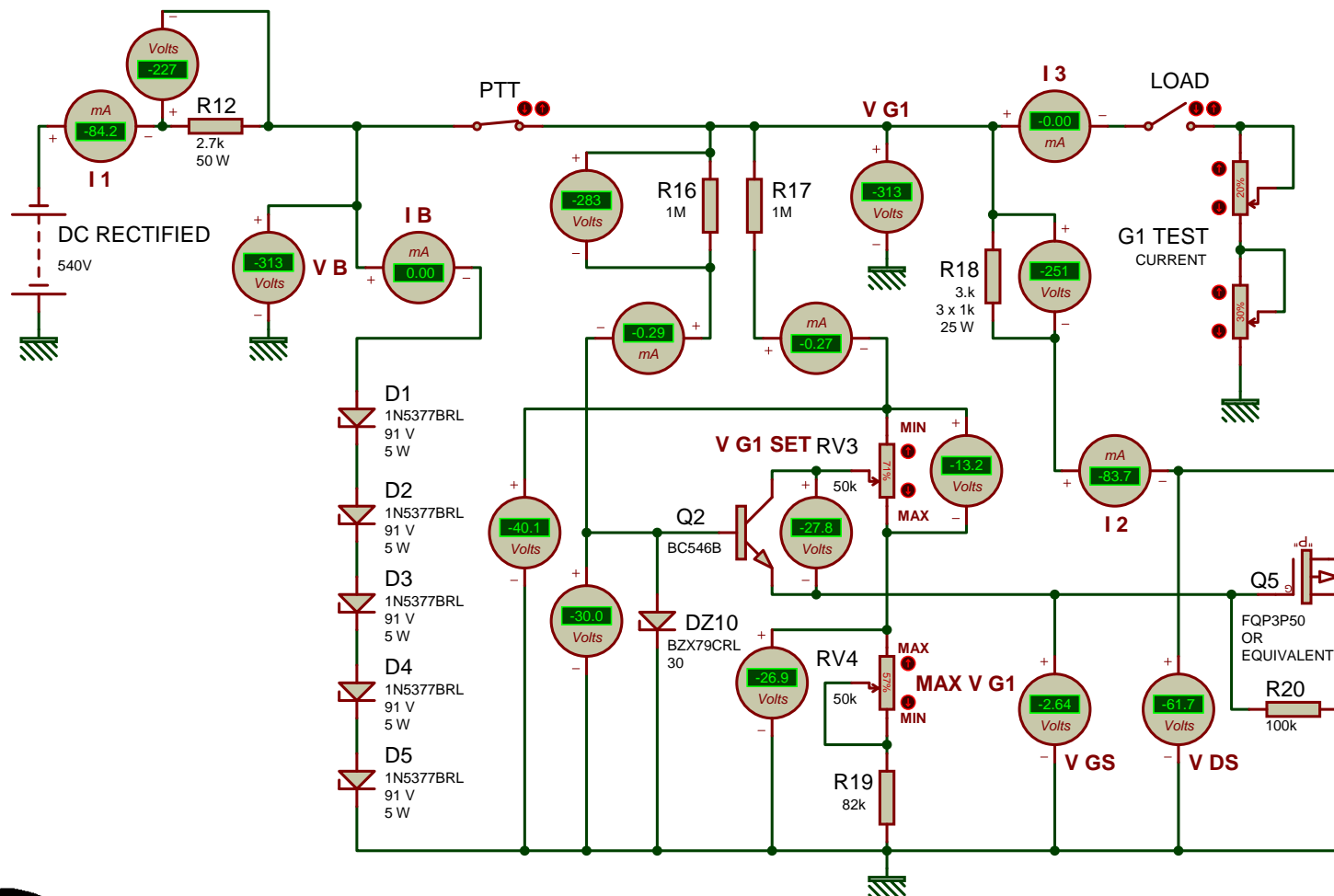
FOR R12 & R18 VALUES, USE EXCEL SHEET: Grid1_Shunt_Supply_Calculator_F1FRV
Simulation files are in "PROTEUS" format. To help you in your design,
If you have PROTEUS & want receive simulation files, request by e-mail.
EXAMPLE FOR 4CX-10 000 D CLASS AB1 WITH G2 : 1250 V
4CX-10 000 D V G1 -455 V / -310 V (-285 V TO -350 V) 50 mA MAX

TETRODE AMPLIFIER DESIGN SUITE
SIMULATION G1 SHUNT SUPPLY CONTROL

DOC N°: Amateur Radio
BY: f1frv@sfr.fr
DATE: 28/01/22 REV: 7 PAGE: 1/1



NOTES If the simulation aborts with "timestep too small" then set : RELTOL=0.005 (up to 0.01) , ITL4=300 (up to 500) , ITL1=300
And in extreme cases (in order of importance) : GMIN=1e-09 , ABSTOL=1e-08 , VNTOL=1e-05 (up to 1e-03) only if required TMAX=10 t

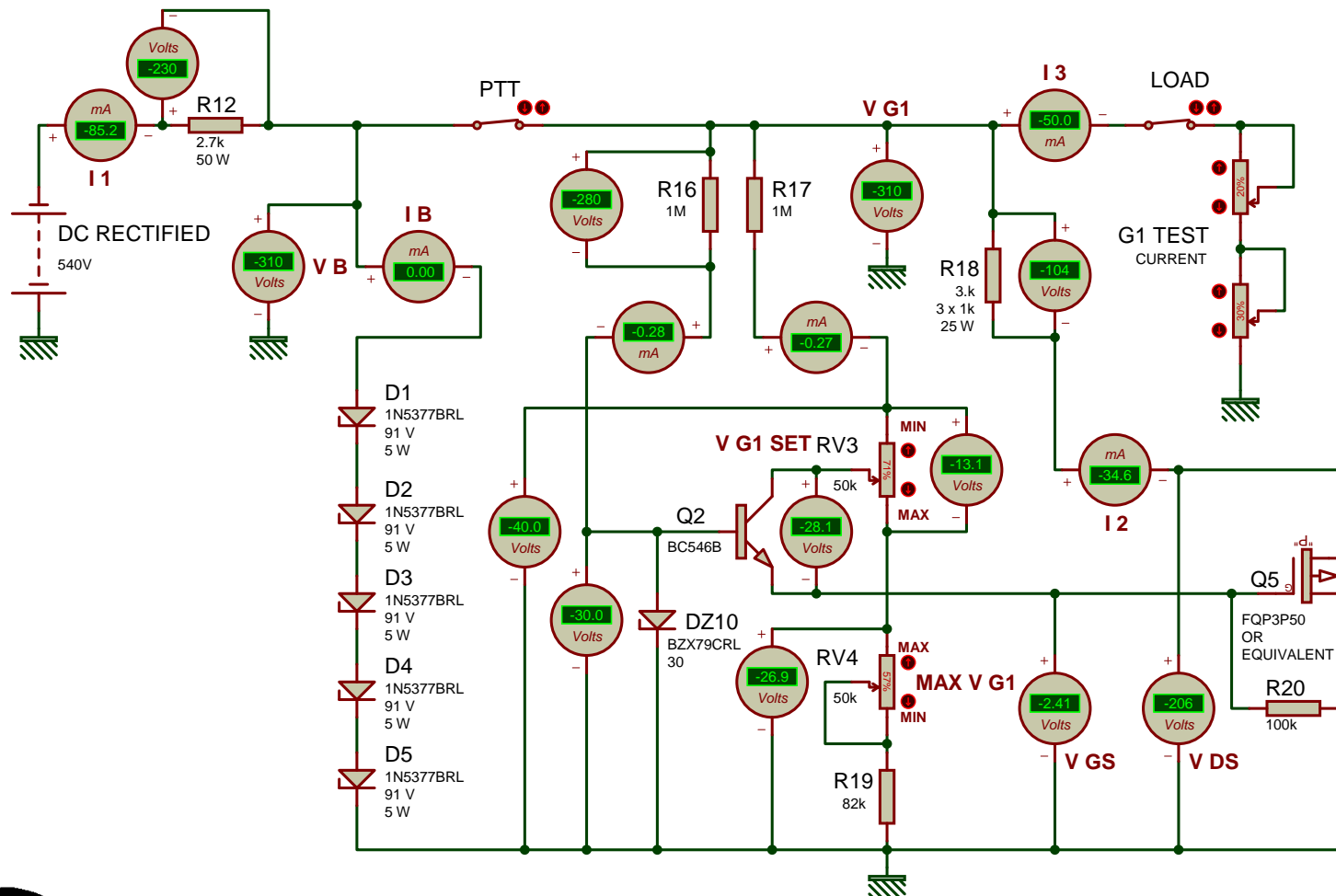


FOR R12 & R18 VALUES, USE EXCEL SHEET: Grid1_Shunt_Supply_Calculator_F1FRV
Simulation files are in "PROTEUS" format. To help you in your design,
If you have PROTEUS & want receive simulation files, request by e-mail.
EXAMPLE FOR 4CX-10 000 D CLASS AB1 WITH G2 : 1250 V
4CX-10 000 D V G1 -455 V / -310 V (-285 V TO -350 V) 50 mA MAX

TETRODE AMPLIFIER DESIGN SUITE
SIMULATION G1 SHUNT SUPPLY CONTROL

DOC N°: Amateur Radio
BY: f1frv@sfr.fr
DATE: 28/01/22 REV: 7 PAGE: 1/1

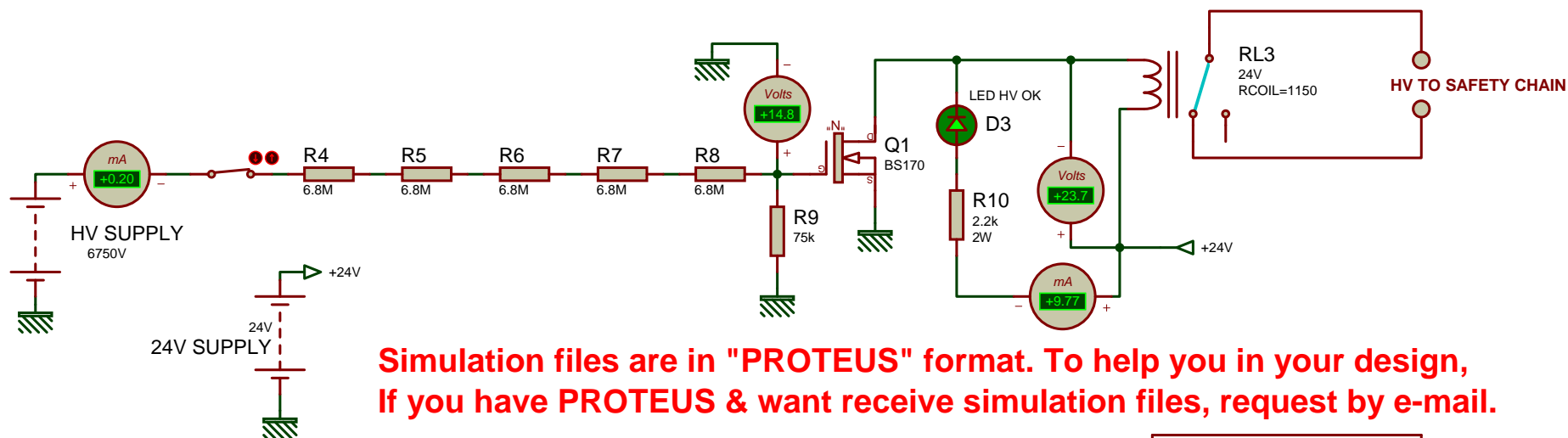
NOTES If the simulation aborts with "timestep too small" then set : RELTOL=0.005 (up to 0.01) , ITL4=300 (up to 500) , ITL1=300
And in extreme cases (in order of importance) : GMIN=1e-09 , ABSTOL=1e-08 , VNTOL=1e-05 (up to 1e-03) only if required TMAX=10 t



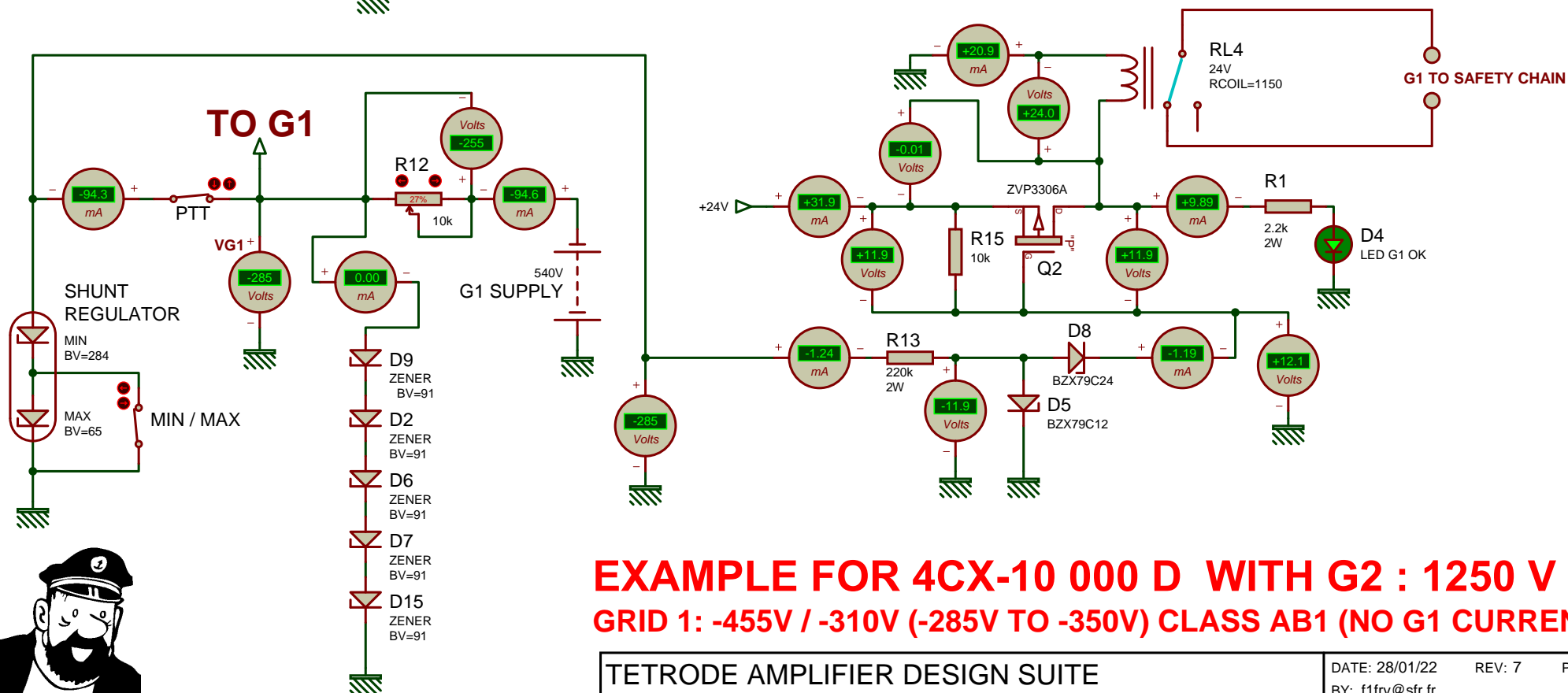
FOR R12 & R18 VALUES, USE EXCEL SHEET: Grid1_Shunt_Supply_Calculator_F1FRV
Simulation files are in "PROTEUS" format. To help you in your design,
If you have PROTEUS & want receive simulation files, request by e-mail.
EXAMPLE FOR 4CX-10 000 D CLASS AB1 WITH G2 : 1250 V
4CX-10 000 D V G1 -455 V / -310 V (-285 V TO -350 V) 50 mA MAX

TETRODE AMPLIFIER DESIGN SUITE
SIMULATION G1 SHUNT SUPPLY CONTROL

DOC N°: Amateur Radio
BY: f1frv@sfr.fr
DATE: 28/01/22 REV: 7 PAGE: 1/1



Simulation files are in "PROTEUS" format. To help you in your design, If you have PROTEUS & want receive simulation files, request by e-mail.

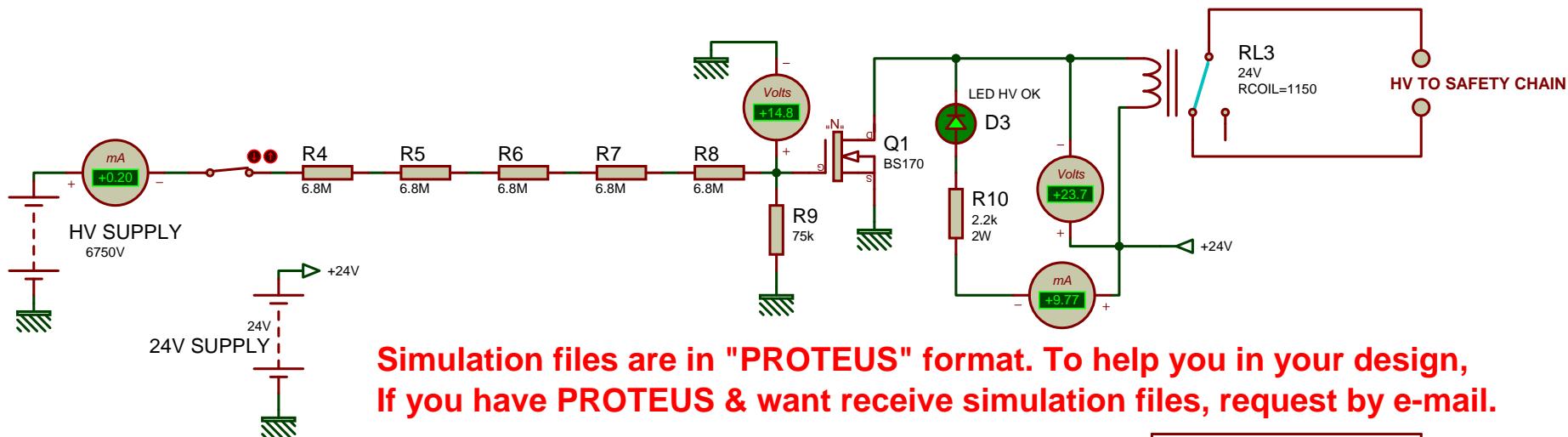


**EXAMPLE FOR 4CX-10 000 D WITH G2 : 1250 V
GRID 1: -455V / -310V (-285V TO -350V) CLASS AB1 (NO G1 CURRENT)**

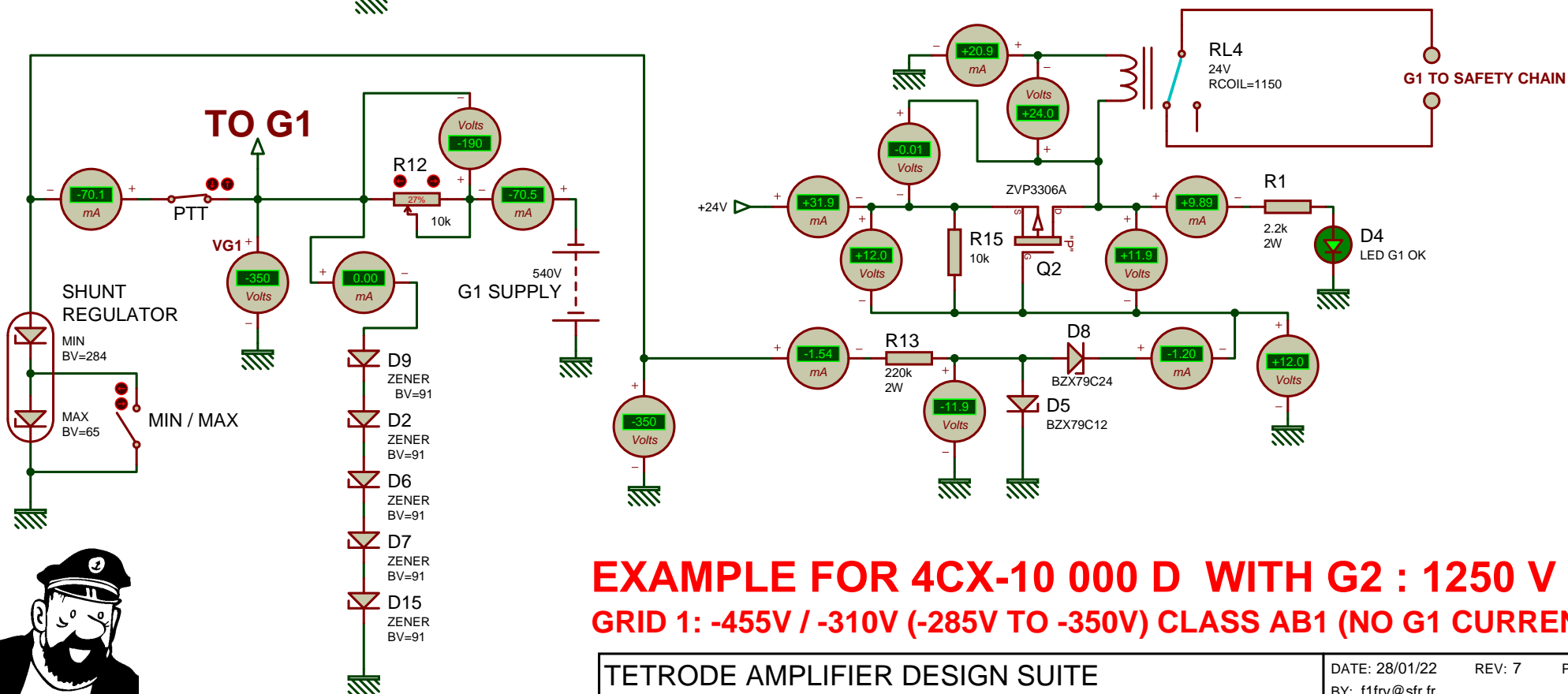
TETRODE AMPLIFIER DESIGN SUITE
SUPPLIES DETECTIONS SIMULATION

DATE: 28/01/22 REV: 7 PAGE: 1/1
BY: f1frv@sfr.fr
DOC N°: Amateur Radio





Simulation files are in "PROTEUS" format. To help you in your design, If you have PROTEUS & want receive simulation files, request by e-mail.



**EXAMPLE FOR 4CX-10 000 D WITH G2 : 1250 V
GRID 1: -455V / -310V (-285V TO -350V) CLASS AB1 (NO G1 CURRENT)**

TETRODE AMPLIFIER DESIGN SUITE
SUPPLIES DETECTIONS SIMULATION

DATE: 28/01/22 REV: 7 PAGE: 1/1
BY: f1frv@sfr.fr
DOC N°: Amateur Radio

