TETRODE BOARD GRID 1 SHUNT REGULATED SUPPLY

Calculation of R12, R18 & blocking voltage Zeners current

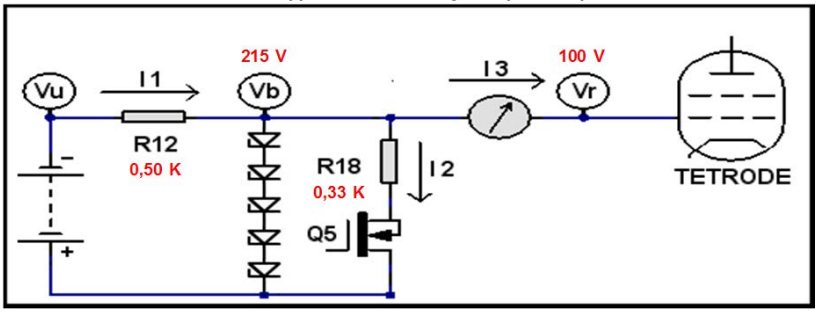
This spreadsheet follows the method described in Application Note 3 7 March 2003 by GM3SEK

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

Rev 0 January 2022

Application Note 3, Figure 2 (modified)



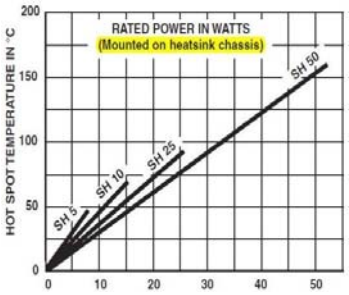
Input cells are **Black** Results are **Red**

Step					
1	**Enter** unregulated input voltage:	**Vu = -** 230	**V at load ~** 260	**mA**	**Tube:** 2 x QBL5-3500
	Estimated transformer voltage before rectifiers & filter:		170	**V AC**	
2	**Enter** G1 BLOCKING voltage:	**Vb = -** 215	**V** 43	**V for each Zener**	
	Blocking voltage Vb Zeners current: -		30	**mA**	
3	**Enter** regulated output voltage:	**Vr = -** 100	**V**		
4	**Enter** maximum grid current:	**I3 = -** 150	**mA**		

Values in Figure 2

I1 =	260	mA
I2 =	*260*	*mA*
I3 =	*150*	*mA*

R12 & R18



Resistor R12:	Use next standard value **below**	0,77	**k**
5 **Enter** value used for R12:	**R12 =** 0,50	**k**	
Power dissipation of R12	34 **W @ I1= -**	260	**mA**
Resistor R18:	Use next standard value **below**	0,38	**k**
6 **Enter** value used for R18:	**R18 =** 0,33	**k**	
Maximum power dissipation of R18 =	26 **W @ I2= -**	260	**mA**

MAXIMUM VDS voltage of Q5 (for Q5 selection) = -	64 **V @ I2= -**	110	**mA**	2 x 1 kOhms 50 W **R12**
MAXIMUM current of Q5 (for Q5 selection) = -	260 **mA @ VDS-**	18	**V**	3 x 1 kOhms 25 W **R18**
MAXIMUM power dissipation of Q5 (for Q5 selection) =	8 **W**			

Heatsink thermal resistance	2,40	**°C/W**	
Q5 Junction to Case	1,47	**°C/W (see datasheet)**	
Insulating pad Rth	0,20	**°C/W**	
Ambiant Temperature:	30	**°C**	
Q5 Junction Temperature:	63	**°C**	

Q5 reference (see datasheet)	FQP3P50	**Q5 Power**	85	**W @ 25°C**
Q5 MAXIMUM Power @ Junction Temperature	59,46 **W**	**Q5 Derating**	0,68	**W / °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)

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

DESIGN CHECK

EXCEPT IF YOU ARE SURE OF INPUT VOLTAGE STABILITY AT I 1 CURRENT, AND NETWORK MINIMUM VOLTAGE.

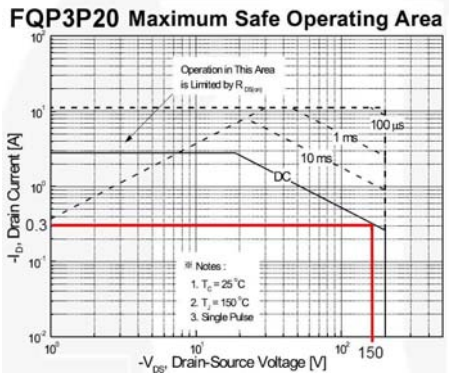
Go back to **Step 2** now, and try a **5% lower** value for Vb. **In cell E26, enter 204 V**

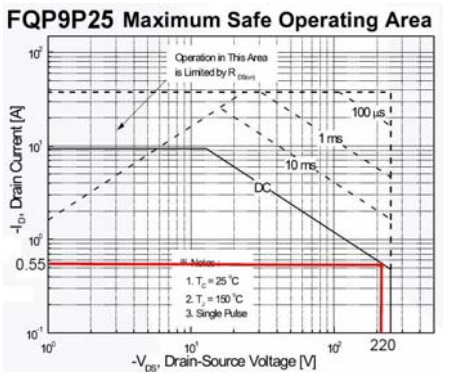
Do you see any red error messages?

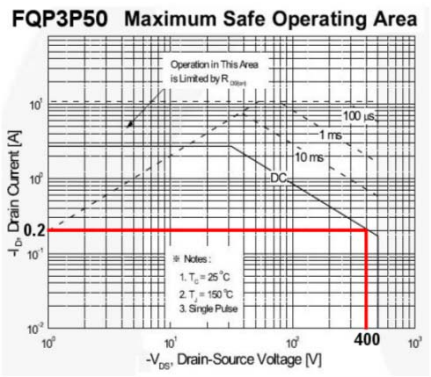
If you see any red error messages, your present resistors values are marginal !

You should reduce the indicated resistor values, and / or increase the transformer voltage,

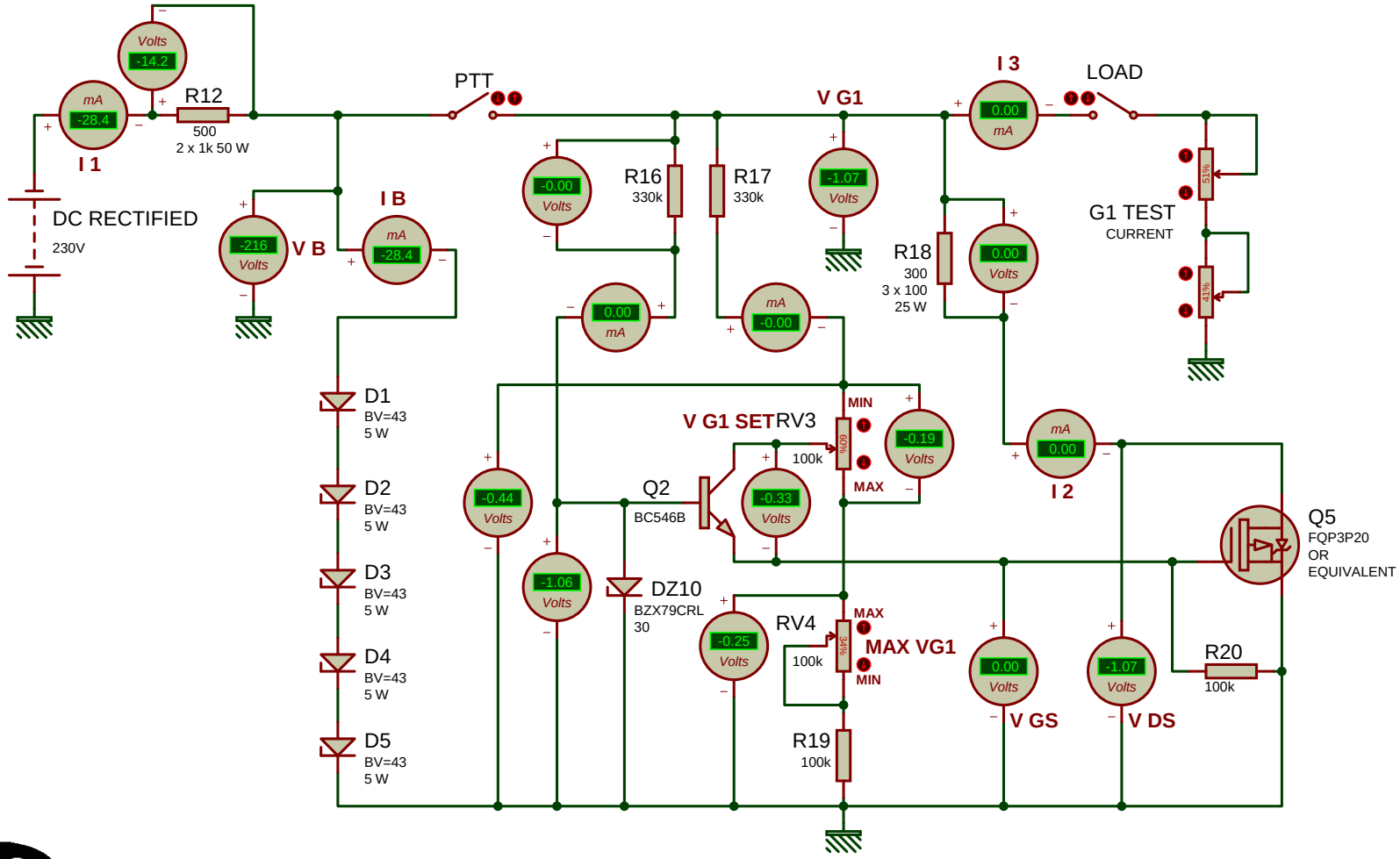
until **NO** error messages appear when you decrease Vb by 5% from your expected minimum value at maximum current. **EXCEPT IF YOU ARE SURE OF INPUT VOLTAGE STABILITY AT I 1 CURRENT, AND NETWORK MINIMUM VOLTAGE.**







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 2 x QBL5-3500 CLASS AB2 WITH G2 : 800 V
QBL5-3500 V G1 -215 V / -100 V (-85 V TO -130 V) 150 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

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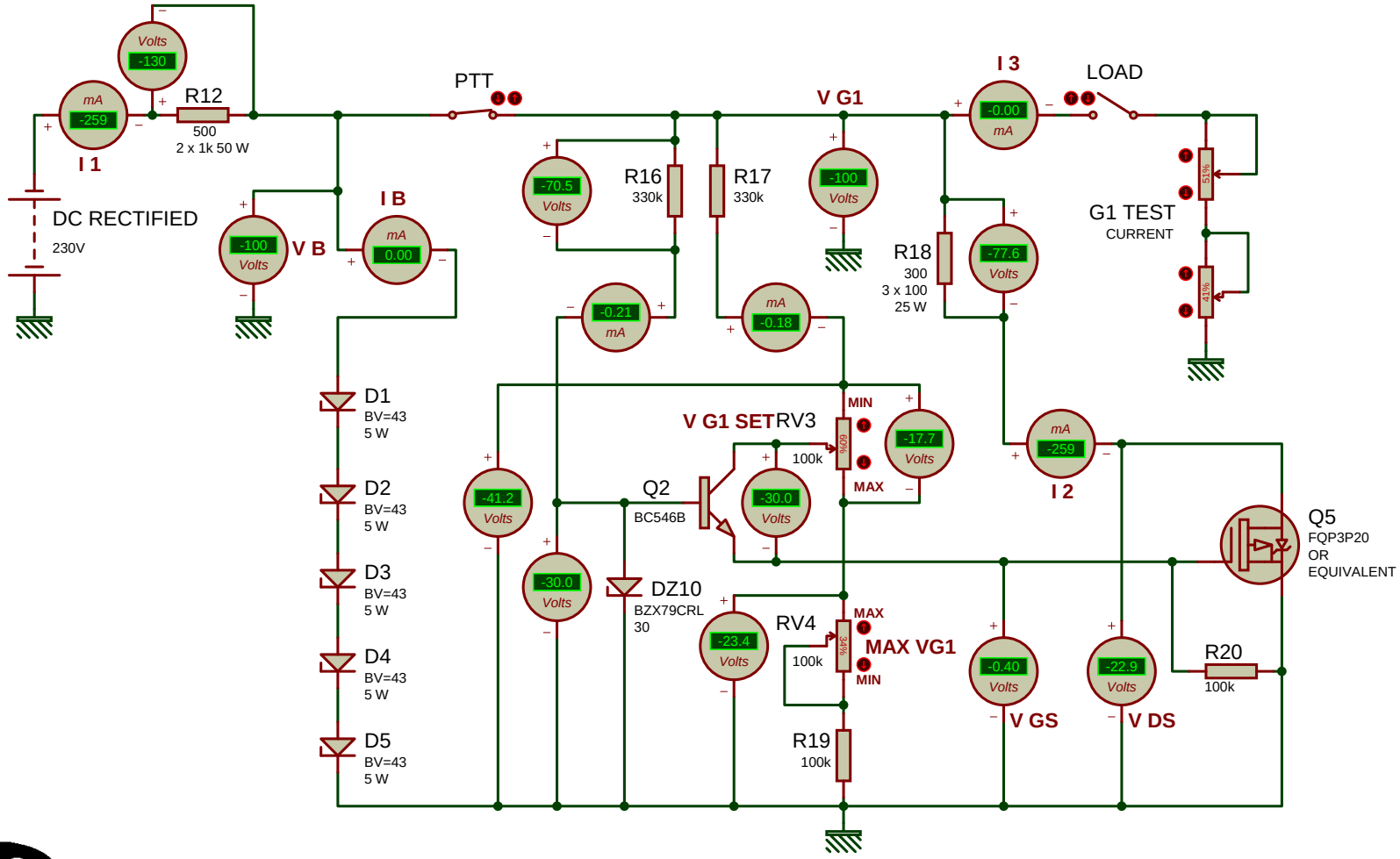

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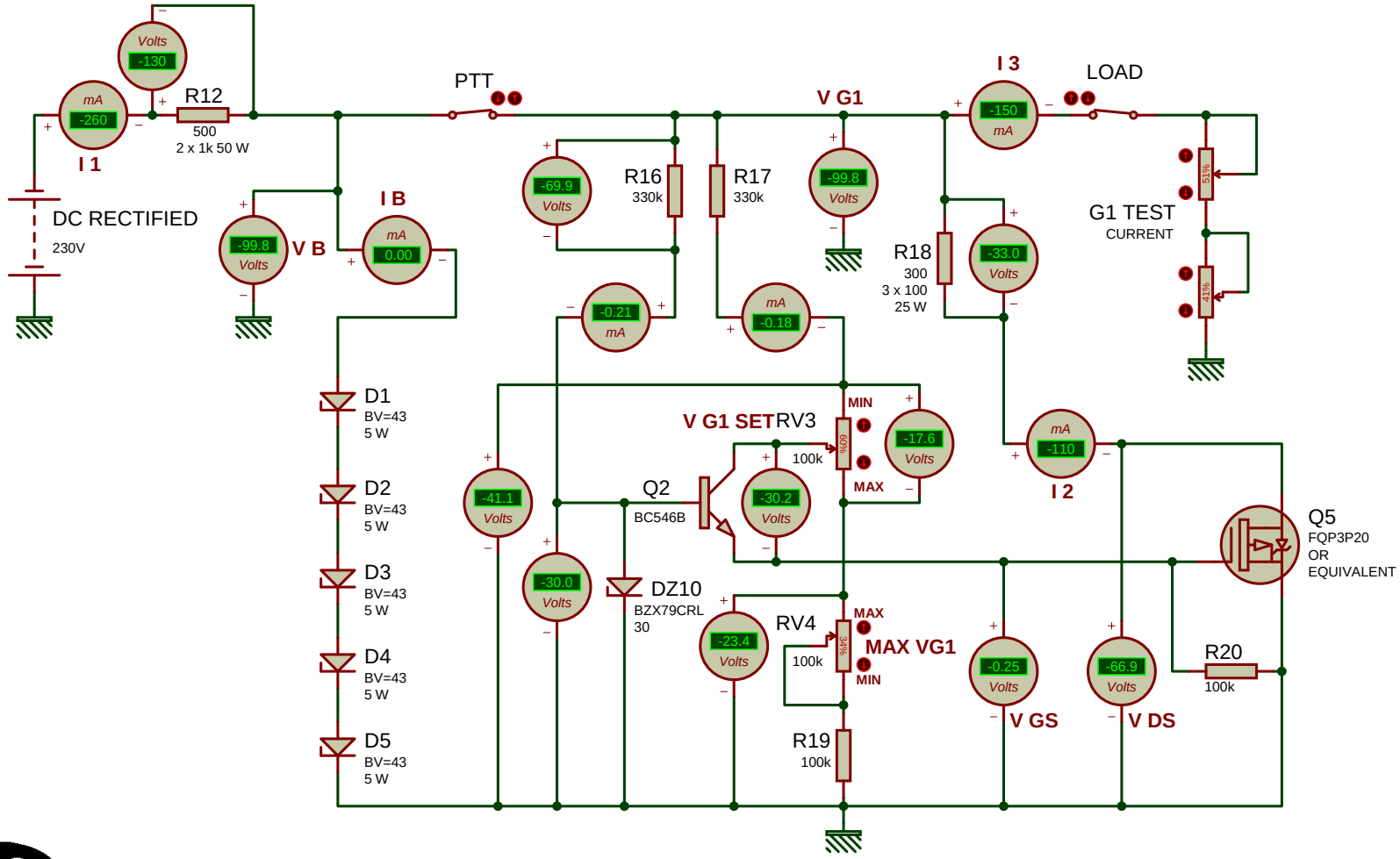

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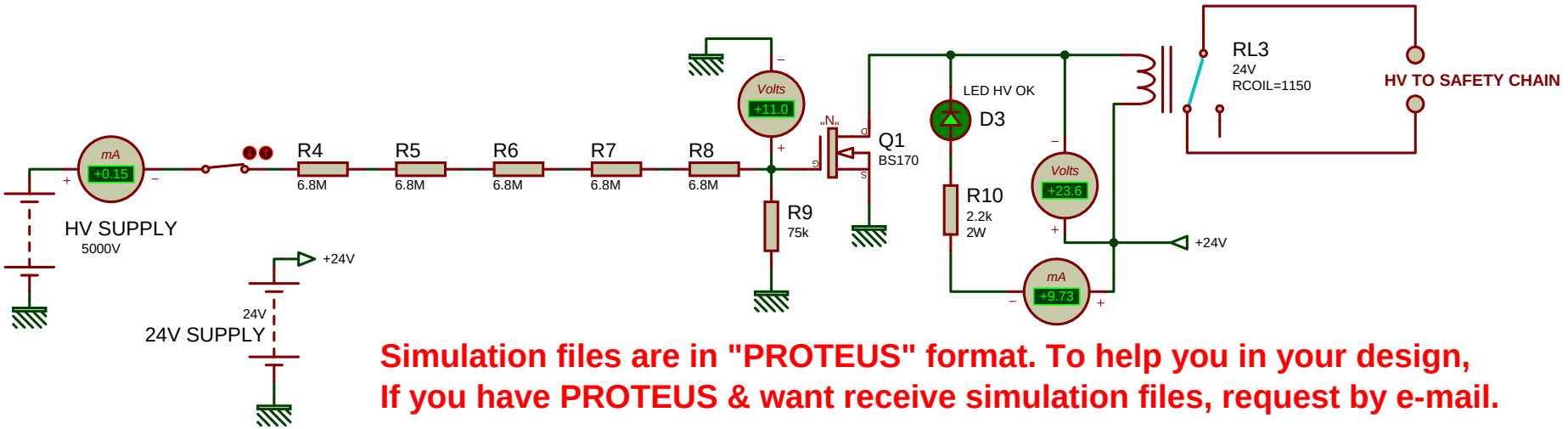

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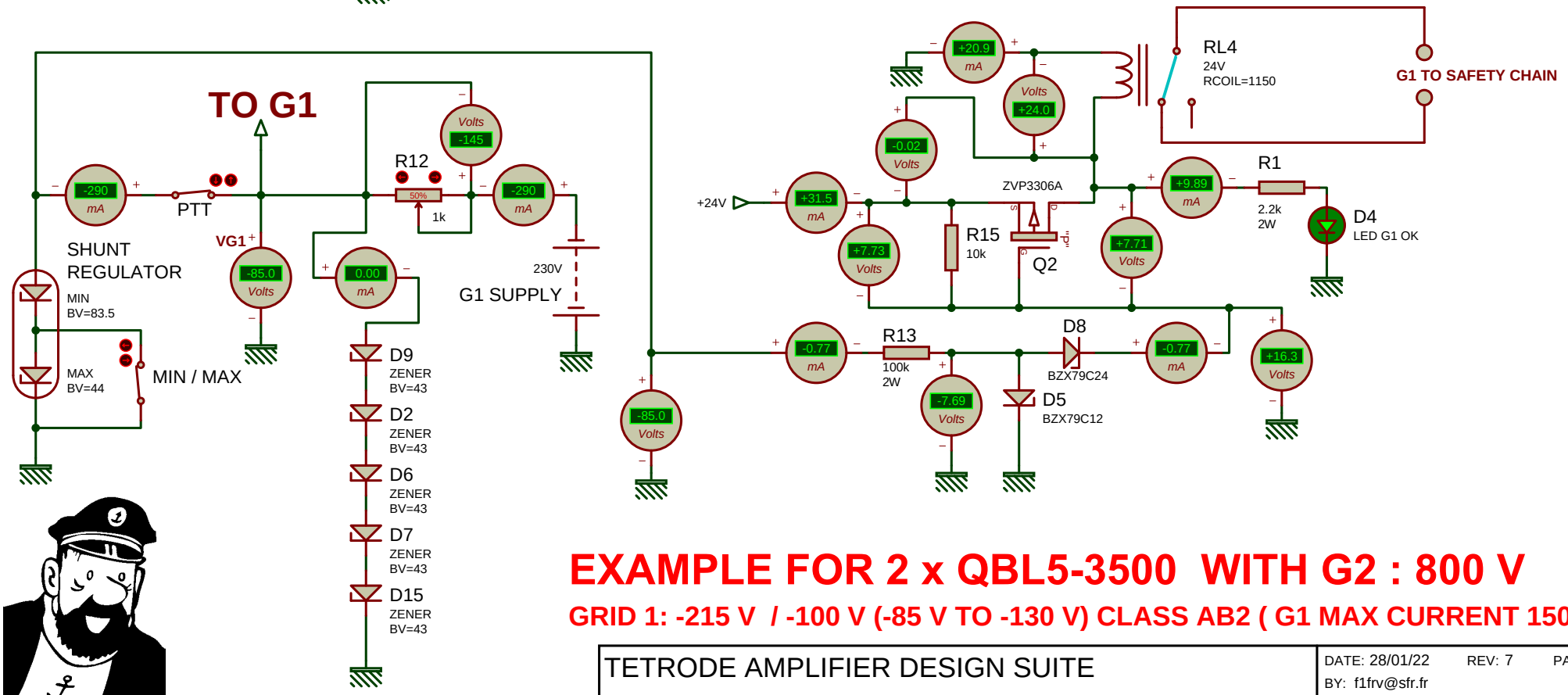

EXAMPLE FOR 2 x QBL5-3500 WITH G2 : 800 V

GRID 1: -215 V / -100 V (-85 V TO -130 V) CLASS AB2 (G1 MAX CURRENT 150 mA)

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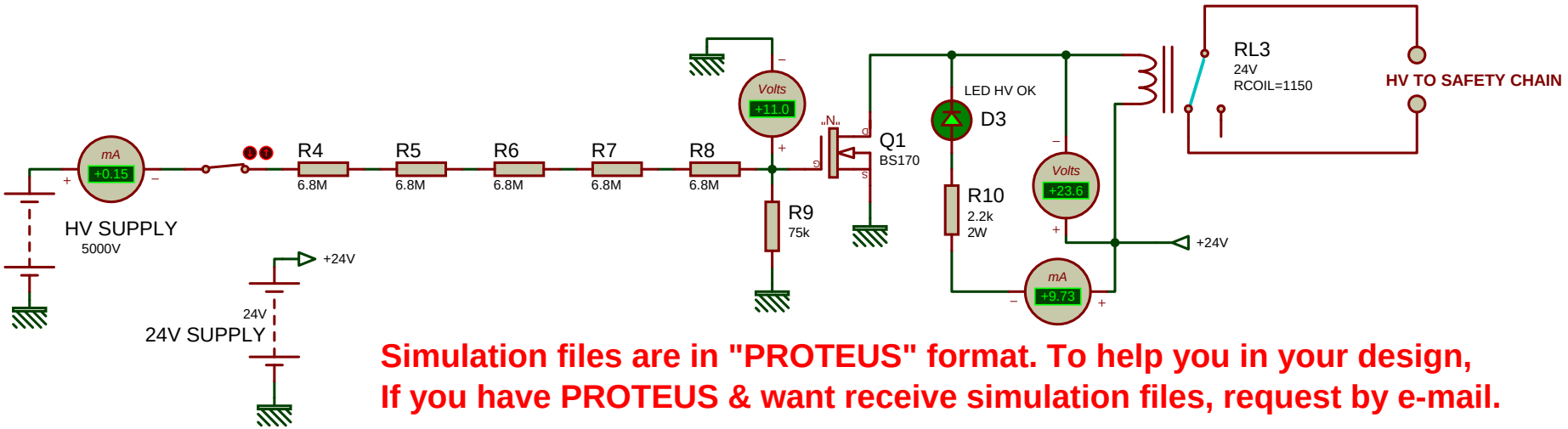

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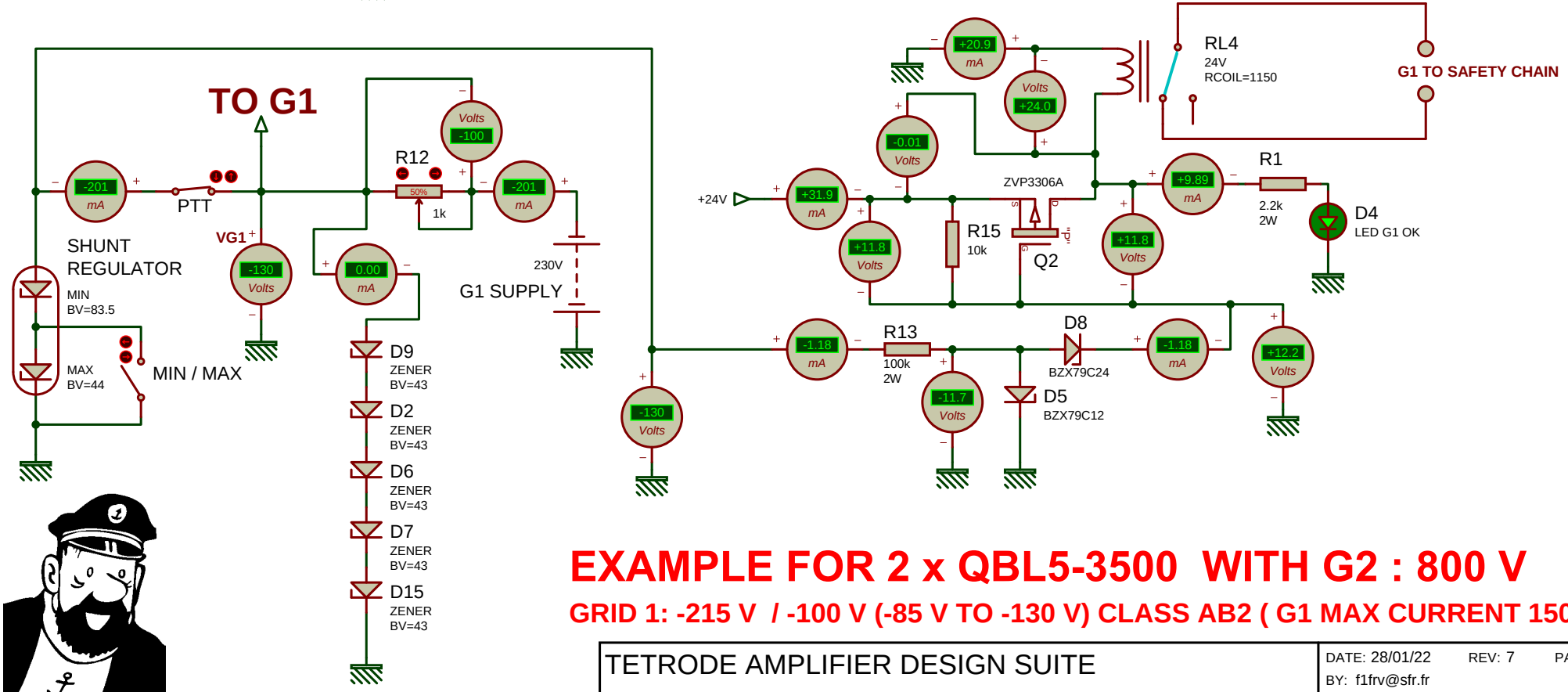

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