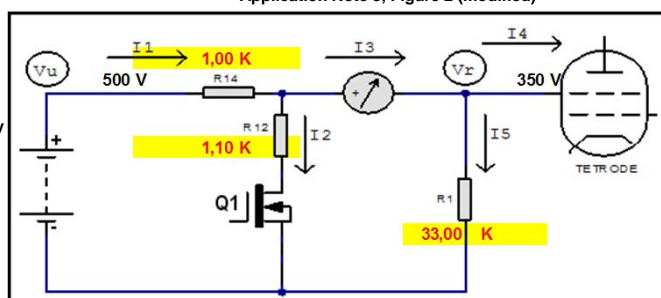


Calculation of R1, R12, R14

Modification for F1FRV board, with power MOSFET or IGBT and Q1 & R1 at DC ground

Application Note 3, Figure 2 (modified)

New modified schematic
Added Q1 VDS min / max display
Safe Operation Area examples
for MOSFETs & IGBTs



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



Tube:
GU-78b or GU-43b

1 Enter unregulated input voltage: **Vu = 500** V at load ~ **150** mA
Estimated transformer voltage before rectifiers & filter: **370** V AC

2 Enter regulated output voltage: $V_r = 350$ V

Resistor R1: Use next standard value below **35,00** k

3 Enter value used for R1: k
Power dissipation of R1 4 W

4 Enter maximum **positive** screen current: $I_4 = + 100$ mA

Minimum value of I2 (keep-alive current for Q1) = **10** mA

Resistor R14: Use next standard value below **1,24** k

5 Enter value used for R14: **R14 = 1,00 k**
Power dissipation of R14 **23 W**

6 Enter maximum **negative** screen current mA

Resistor R12: Use next standard value below **1,96** k

7 Enter value used for R12: **R12 = 1,10 k**
Maximum power dissipation of R12 = **38 W @ I2= 179 mA**

(for Q1 selection) **VDS** voltage @ Max dissipation = **156 V @ I2= + 179 mA**

(for Q1 selection) **MAXIMUM** current = 179 mA @ VDS= 156 V

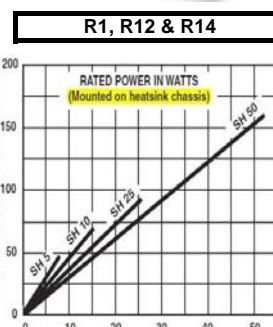
(for Q1 selection) **MAXIMUM** power dissipation = 28 W @ $I_2 = 50$ mA

(for Q1 selection) **MAXIMUM VDS** voltage @ Min dissipation = **323 V @ I2= + 100 mA**

Q1 reference (see datasheet) **STW11NK100Z** Q1 Power **230** W @ 25°C

Q1 MAXIMUM Power @ Junction Temperature	105 W	Q1 Derating	1,85 W / °C
--	--------------	-------------	--------------------

Heatsink thermal resistance	1,5	°C/W
Q1 Junction to Case	0,54	°C/W (see datasheet)
Insulating pad Rth	0,20	°C/W
Ambiant temperature:	30	°C
Q1 Junction Temperature:	92	°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 SERIALIZED TO OBTAIN THE DESIRED VALUE (EG. 2 x 470 50 W in SERIE TO HAVE 0,94 K 100 W)

Go back to **Step 1** now, and try a **5% lower** value for V_u . In cell D24, enter 475 V

Do you see any red error messages?

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

You should reduce the indicated resistor values, and/or increase the transformer voltage, until **no** error messages appear when you decrease V_u by 5% from your expected minimum value at maximum current. EXCEPT IF YOU ARE SURE OF INPUT VOLTAGE STABILITY AT 11 CURRENT. AND NETWORK MINIMUM VOLTAGE.

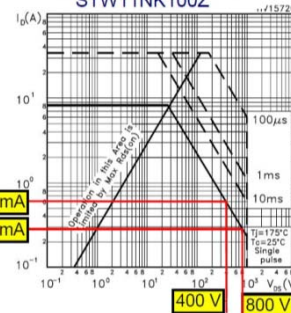


Fig. 11. Forward-Bias Safe Operating Area

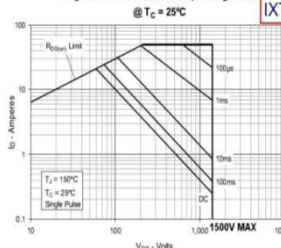
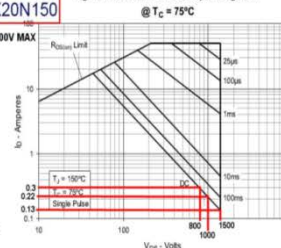
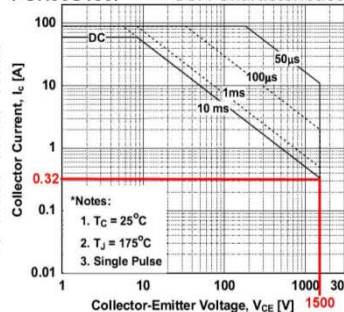


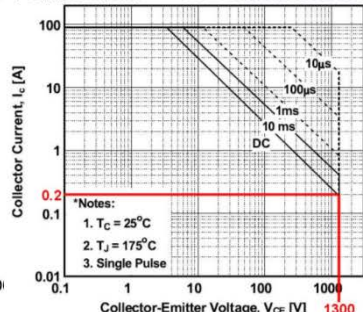
Fig. 12. Forward-Bias Safe Operating Area



FGH30S150P

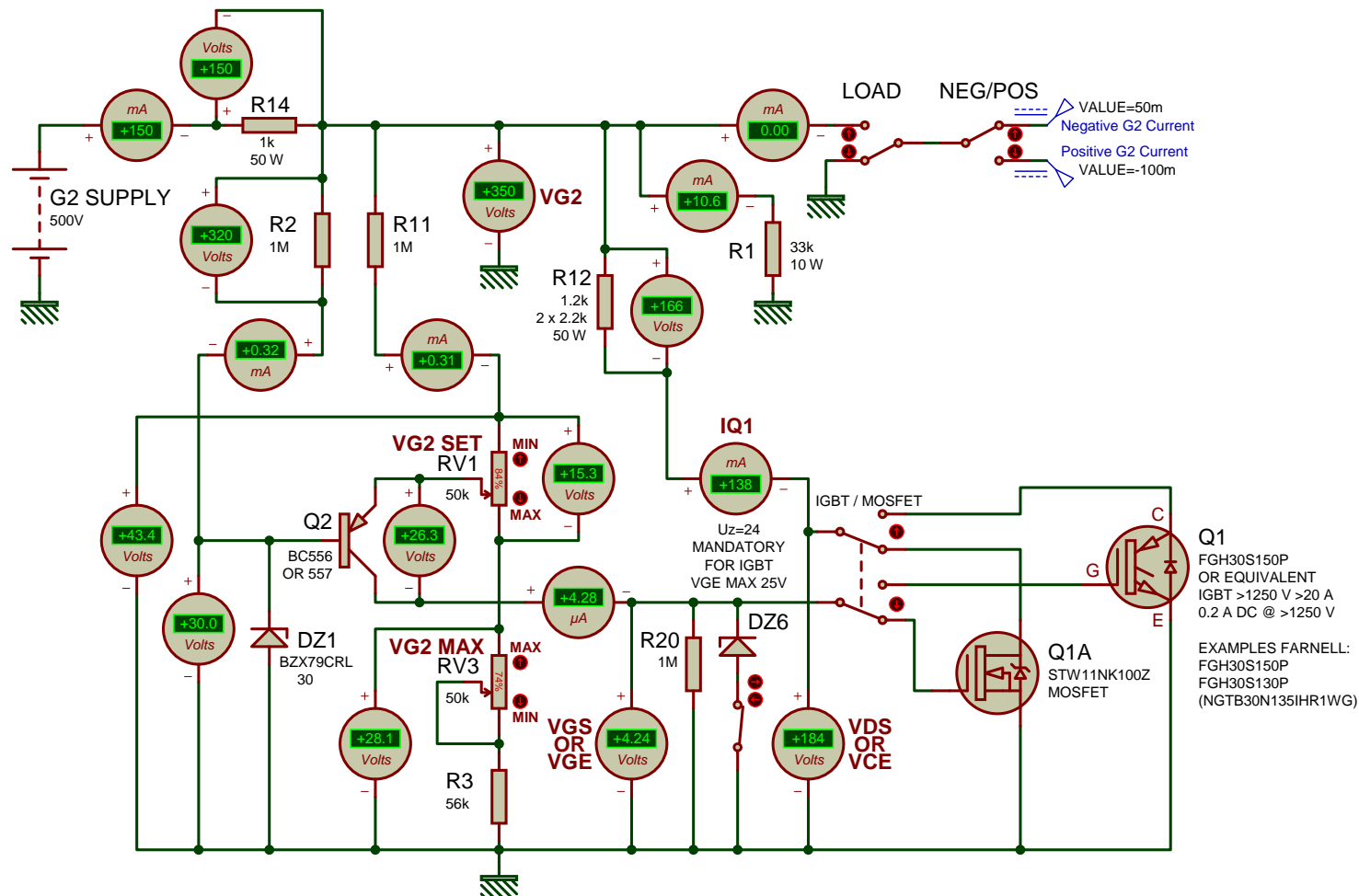


FGH30S130P



AS HIGH VOLTAGE MOSFETs FOR $G2 > 800 \text{ V}$ ARE DIFFICULT TO FIND,
USE IGBTs . LESS EXPANSIVES & MORE EASY TO APPROVIDE.

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 R1, R12 & R14 VALUES, USE EXCEL SHEET: Grid2_G3SEK_an-3-v1.0_Mod_F1FRV

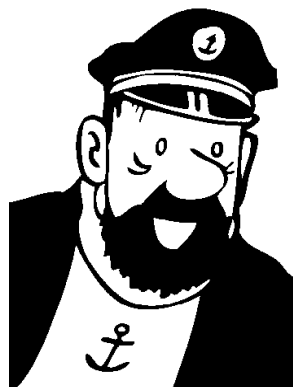
Simulation files are in "PROTEUS" format. To help you in your design, If you have PROTEUS & want receive simulation files, request by e-mail.

EXAMPLE FOR GU-78B OR GU-43B WITH G2 : 350 V

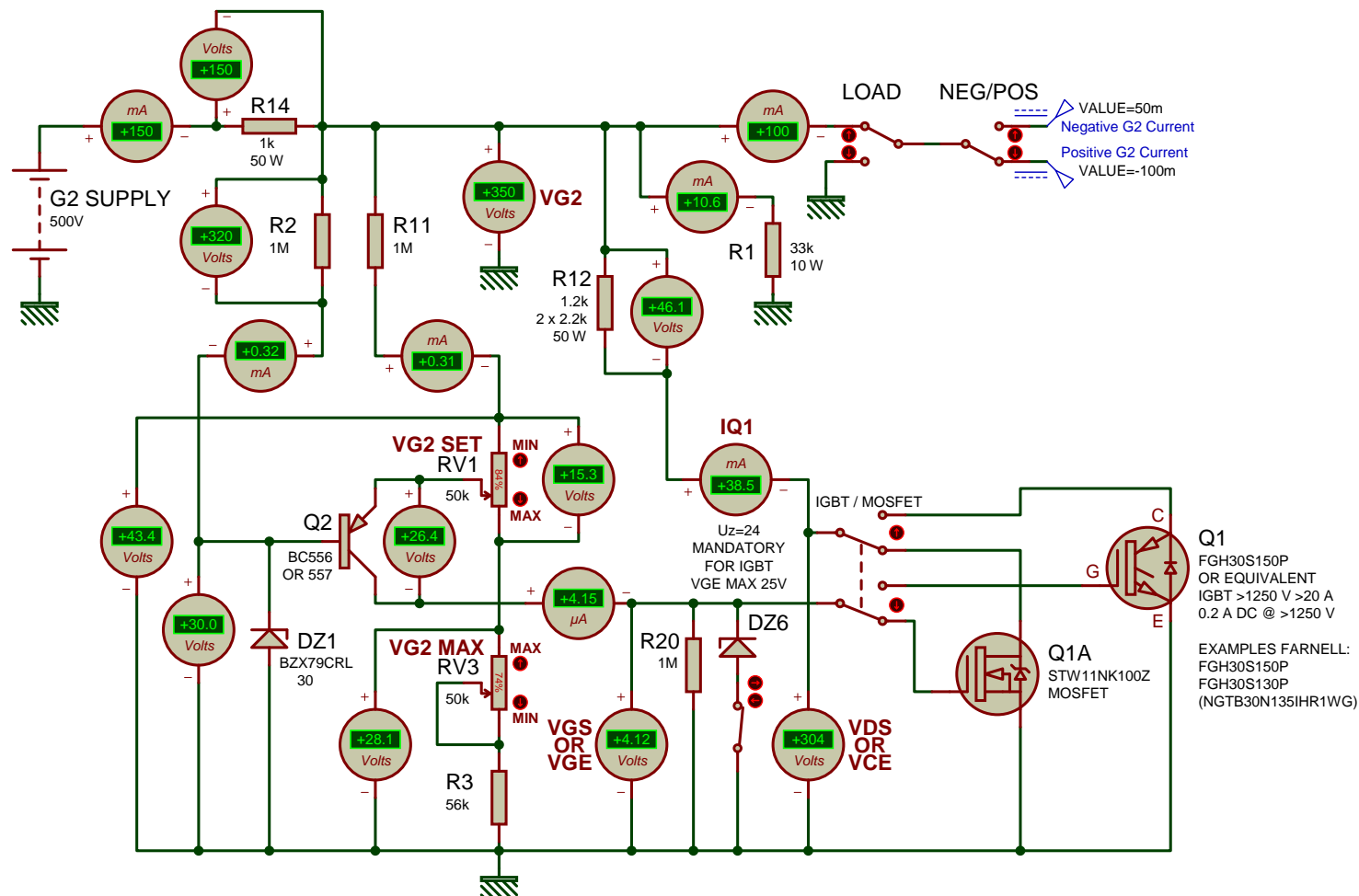
V G2 350 V (260 V TO 380 V) +100 / -50 mA MAX With MOSFET OR IGBT

TETRODE AMPLIFIER DESIGN SUITE
SIMULATION G2 SHUNT SUPPLY CONTROL

DOC N°: Amateur Radio
BY: f1frv@sfr.fr
DATE: 27/01/22 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 R1, R12 & R14 VALUES, USE EXCEL SHEET: Grid2_G3SEK_an-3-v1.0_Mod_F1FRV

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EXAMPLE FOR GU-78B OR GU-43B WITH G2 : 350 V

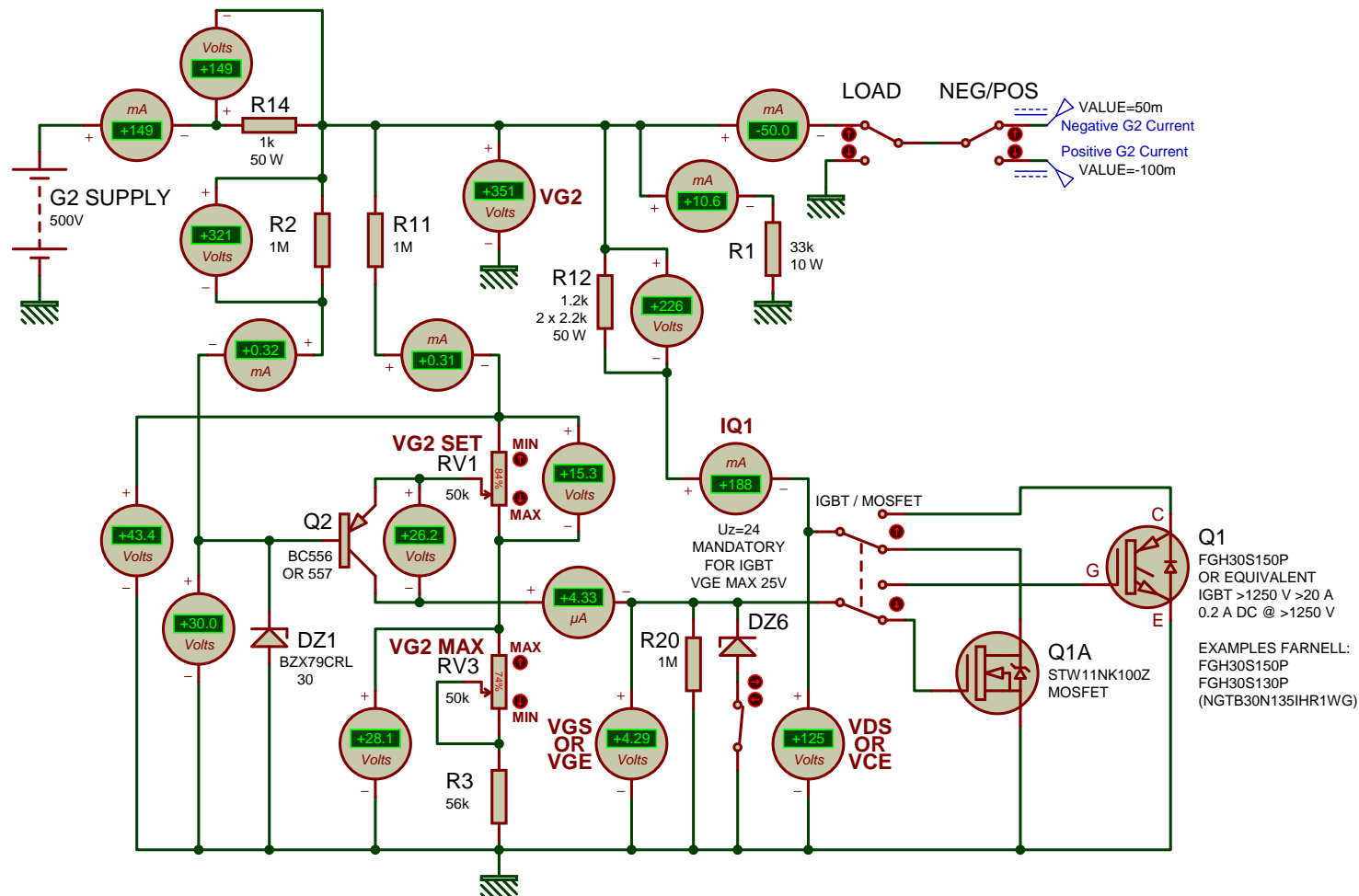
V G2 350 V (260 V TO 380 V) +100 / -50 mA MAX With MOSFET OR IGBT

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FOR R1, R12 & R14 VALUES, USE EXCEL SHEET: Grid2_G3SEK_an-3-v1.0_Mod_F1FRV

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EXAMPLE FOR GU-78B OR GU-43B WITH G2 : 350 V

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