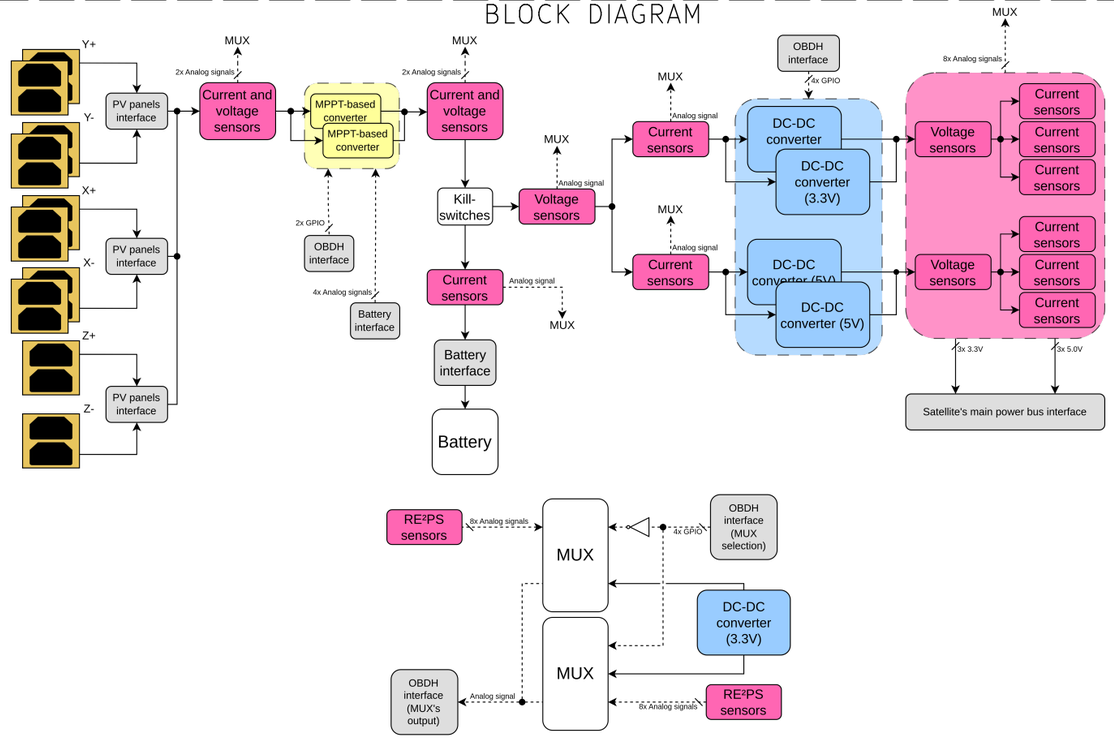
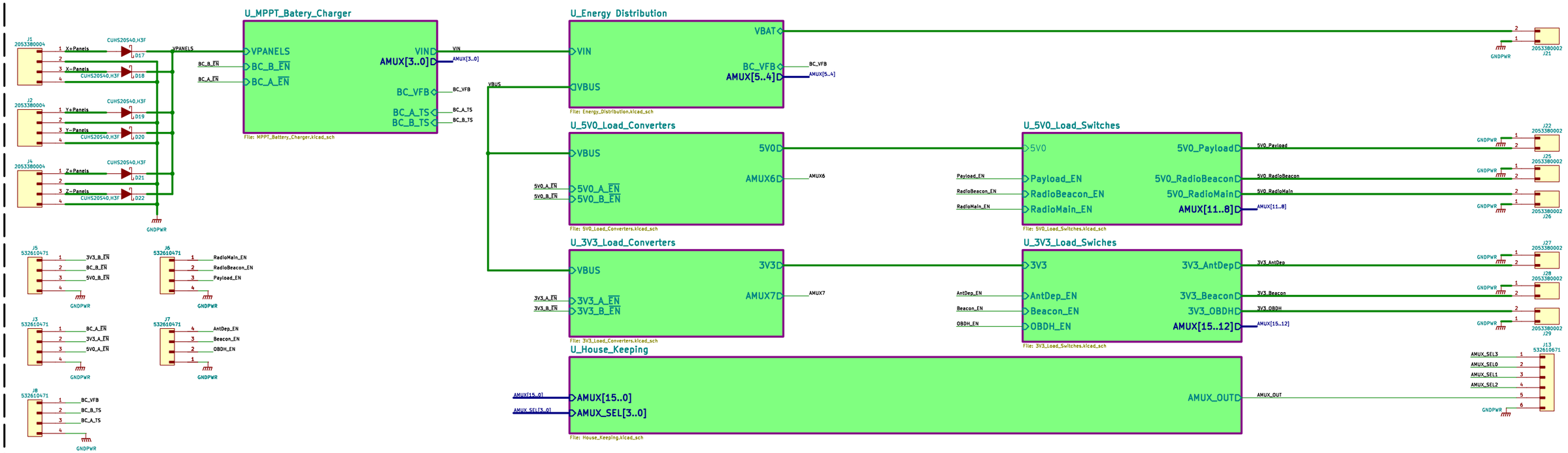
REVISION HISTORY

Version	Modifications	Authors
v0.0	Development of the RE²PS circuit. The methodology is presented in https://repositorio.ufsc.br/handle/123456789/247559.	Davi Figueiredo
v0.1	Changes to the RE²PS schematic. Development of its first PCB layout considering the ECSS-Q-ST-70-12C.	João Cláudio E. B., Laura Debastiani and Rebecca Quintino do Ó

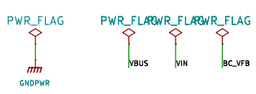
BLOCK DIAGRAM



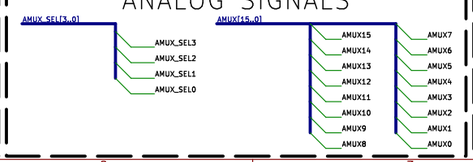
MAIN CIRCUIT



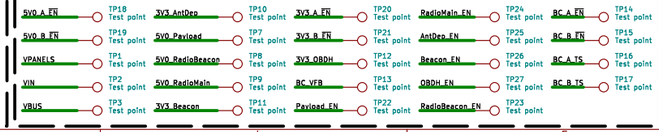
POWER FLAGS



ANALOG SIGNALS



TEST POINTS



MOUNTING HOLES

Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaoclaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

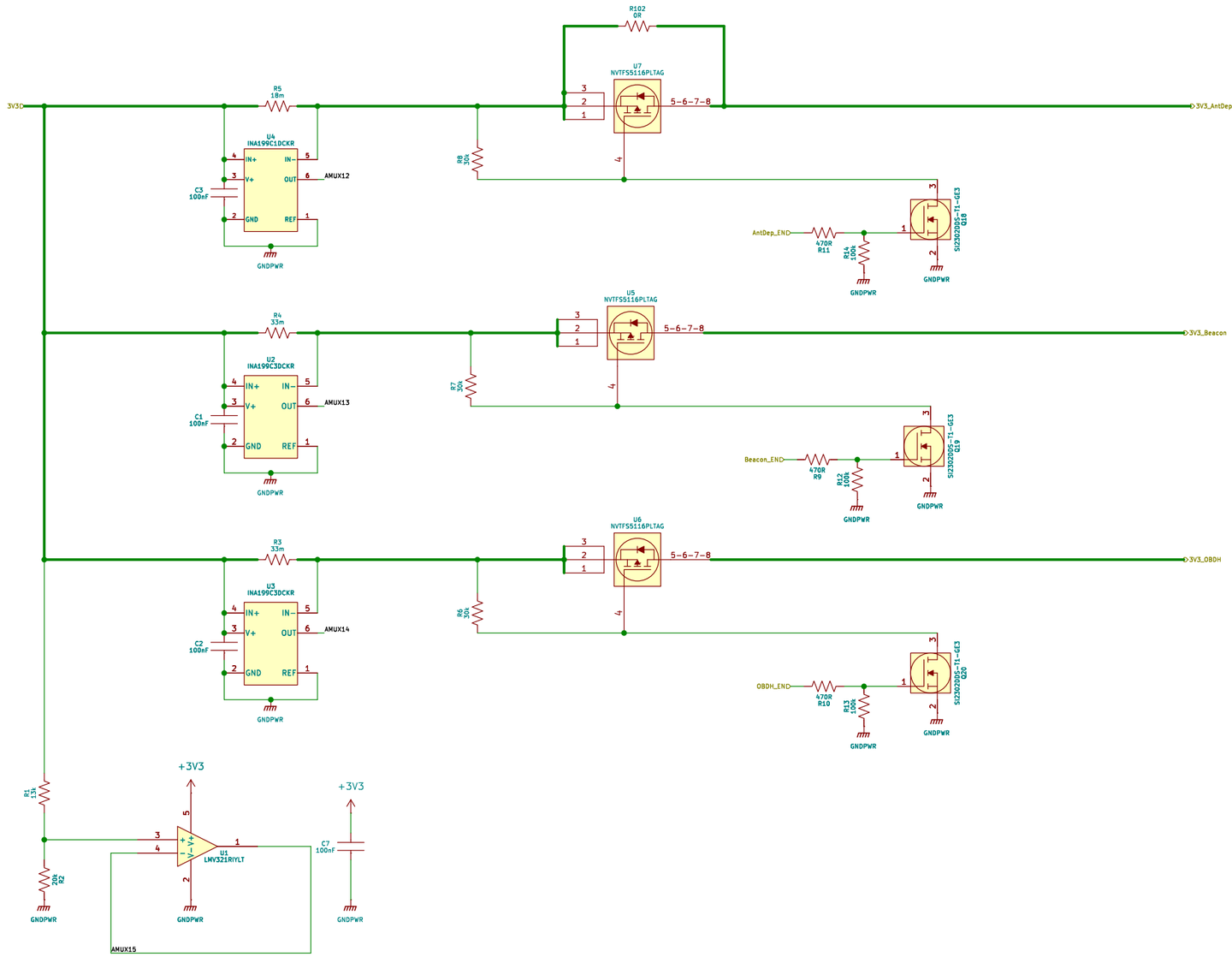
SPACELAB

Sheet: /
File: eps-re_project.kicad_sch

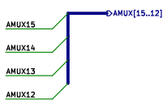
Title: Reliability Enhanced Electrical Power System

Size: A3 | Date: 2023-08-03 | **Rev: v0.0**

KiCad E.D.A. 8.0.4 | Id: 1/8



ANALOG SIGNALS



POWER FLAGS

OUTPUTS CHARACTERISTICS

3V3_AntDep:

Output current ≤ 2A
Output voltage = 3.3V

3V3_Beacon:

Output current ≤ 300mA
Output voltage = 3.3V

3V3_OBDH:

Output current ≤ 300mA
Output voltage = 3.3V

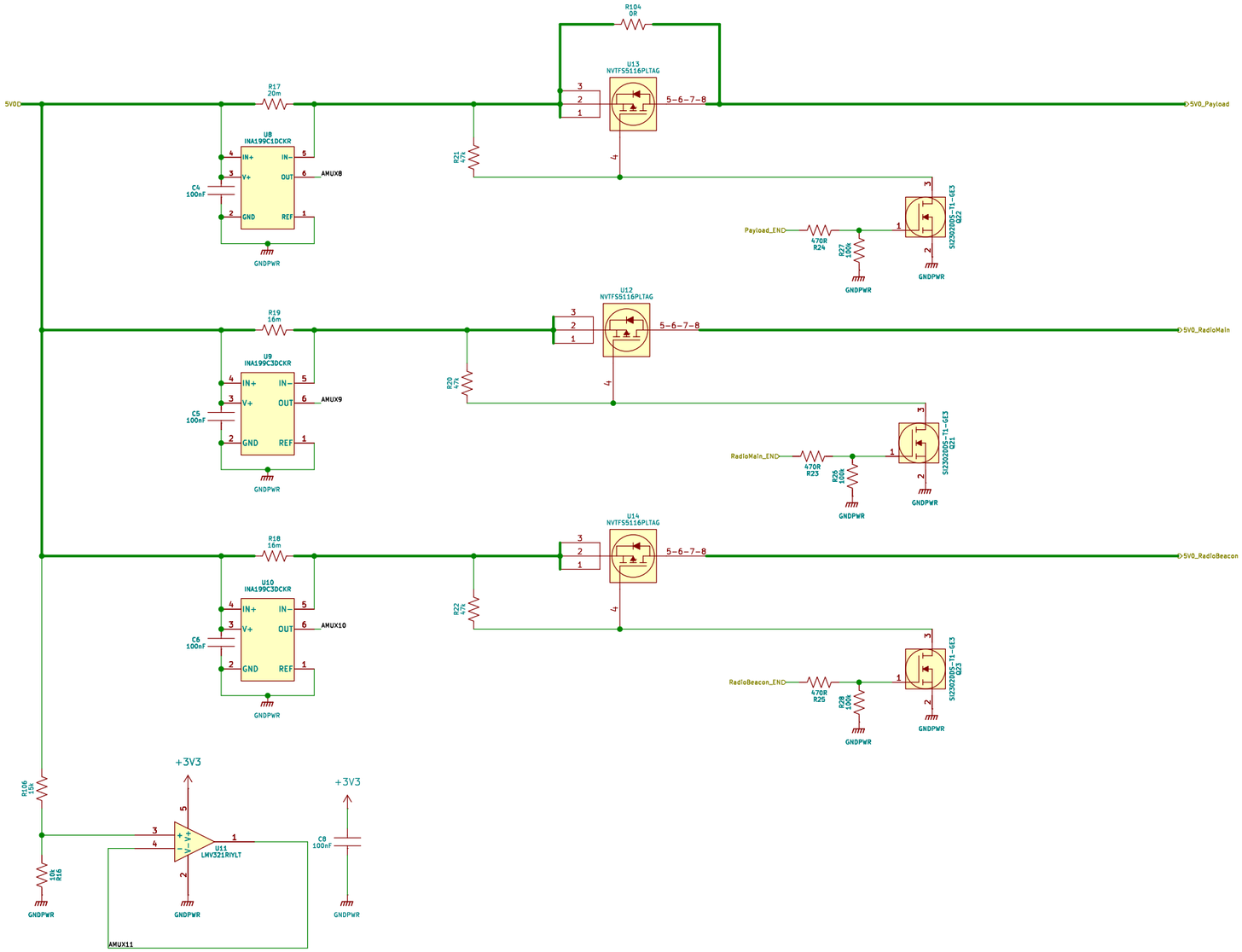
Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaociaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

SPACELAB

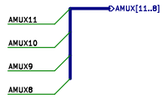
Sheet: /U_3V3_Load_Swiches/
File: 3V3_Load_Switches.kicad_sch

Title: Reliability Enhanced Electrical Power System

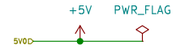
Size: A3	Date: 2023-08-03	**Rev: v0.0**
KiCad E.D.A. 8.0.4		Id: 2/8



ANALOG SIGNALS



POWER FLAGS



OUTPUTS CHARACTERISTICS

5V0_Payload:

Output current ≤ 2A
Output voltage = 5V

5V0_RadioMain:

Output current ≤ 600mA
Output voltage = 5V

5V0_RadioBeacon:

Output current ≤ 600mA
Output voltage = 5V

Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaoclaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

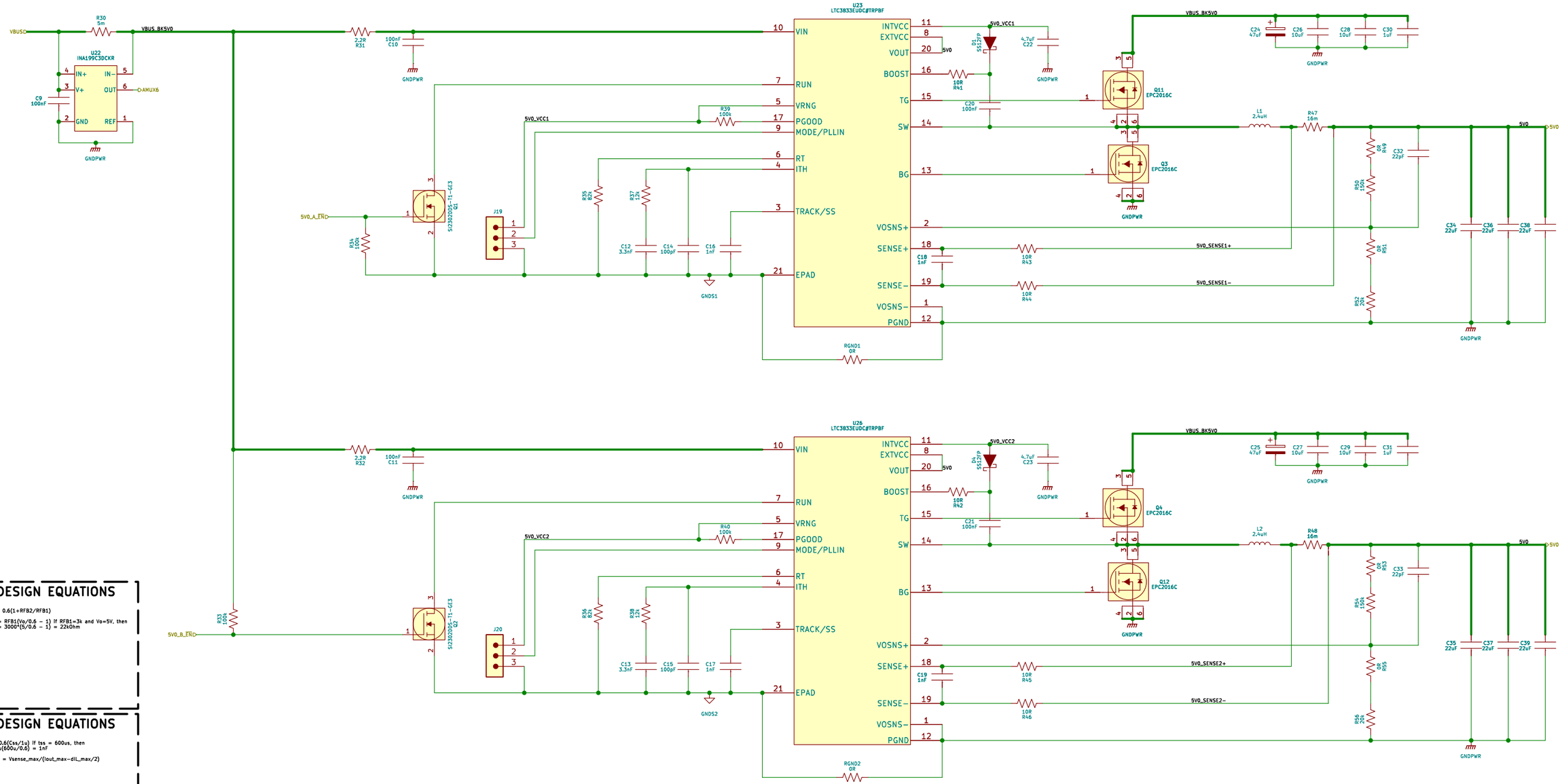
SPACELAB

Sheet: /U_5V0_Load_Switches/
File: 5V0_Load_Switches.kicad_sch

Title: Reliability Enhanced Electrical Power System

Size: A3 | Date: 2023-08-03 | **Rev: v0.0**

KiCad E.D.A. 8.0.4 | Id: 3/8



DESIGN EQUATIONS

Vout = 0.6(1+RFB2/RFB1)

RFB2 = RFB1(Vo/0.6 - 1) If RFB1=3k and Vo=5V, then
RFB2 = 3000*(5/0.6 - 1) = 22kOhm

DESIGN EQUATIONS

tss = 0.6(Css/1u) If tss = 600us, then
Css=1u(600u/0.6) = 1nF

Rsense = Vsense_max/(Iout_max-dIL_max/2)

DESIGN EQUATIONS

Rt[kOhm] = (41550/Fsw[kHz] -2)

If Fsw = 500kHz, then
Rt = 41550/500 -2 = 81.1kOhm

DESIGN EQUATIONS

0.75 < Run < 1.2: TG and BG off

Run<0.75: Shutdown mode

ANALOG SIGNALS

POWER FLAGS

PWR_FLAG PWR_FLAG

GNDS1 GNDS2

TEST POINTS

5V0 TP4 Test point

Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaoclaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

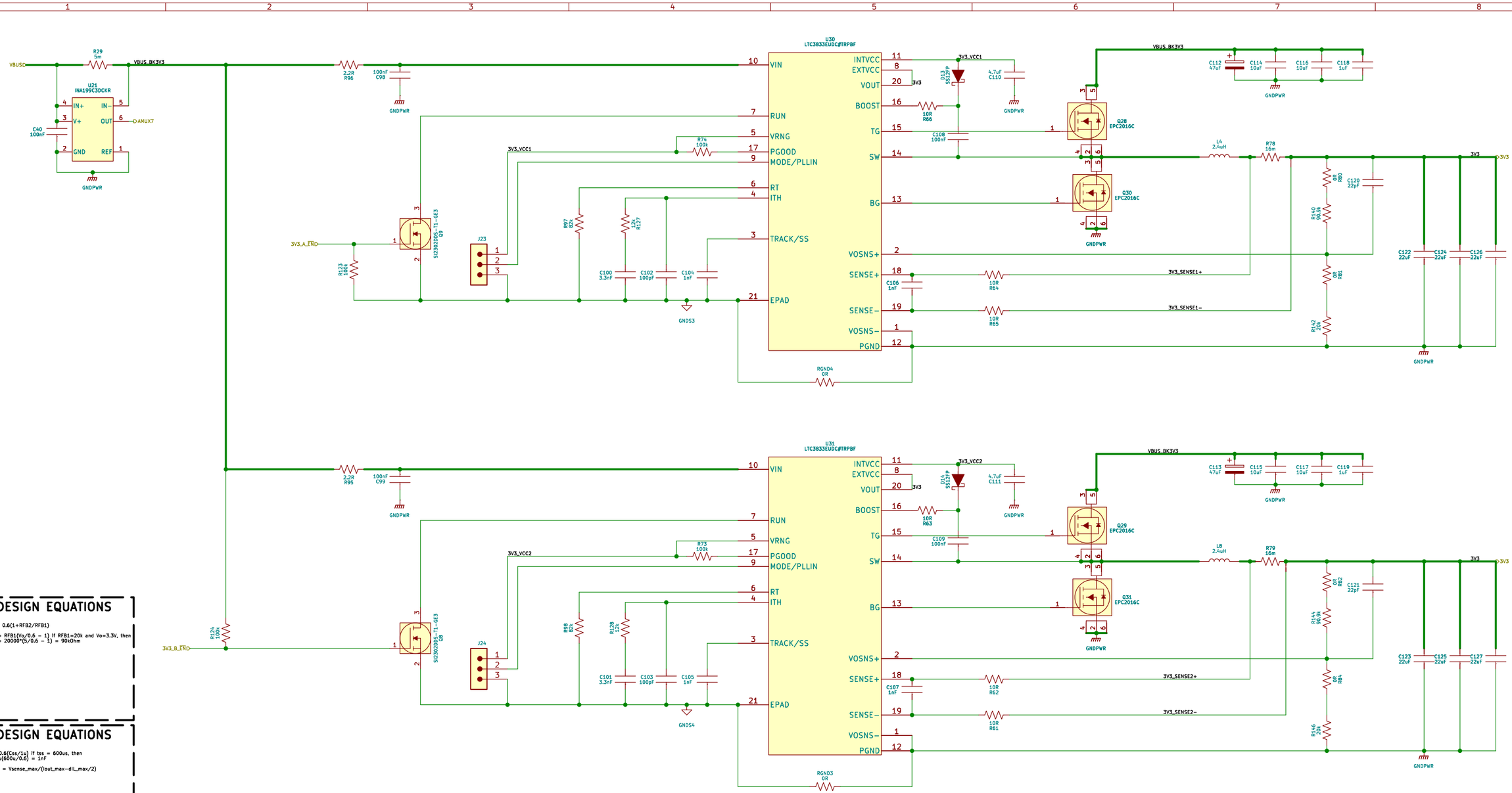
SPACELAB

Sheet: /U_5V0_Load_Converters/
File: 5V0_Load_Converters.kicad_sch

Title: *Reliability Enhanced Electrical Power System*

Size: A3 | Date: 2023-08-03 | **Rev: v0.0**

KiCad E.D.A. 8.0.4 | Id: 4/8



DESIGN EQUATIONS

Vout = 0.6(1+RFB2/RFB1)

RFB2 = RFB1(Vo/0.6 − 1) If RFB1=20k and Vo=3.3V, then
RFB2 = 20000*(3/0.6 − 1) = 90kOhm

DESIGN EQUATIONS

tss = 0.6(Css/1u) If tss = 600us, then
Css=1u(600u/0.6) = 1nF

Rsense = Vsense_max/(Iout_max-dIl_max/2)

DESIGN EQUATIONS

Rt[kOhm] = (41550/Fsw[kHz] −2)

If Fsw = 500kHz, then
Rt = 41550/500 −2 = 81.1kOhm

DESIGN EQUATIONS

0.75 < Run < 1.2: TG and BG off

Run<0.75: Shutdown mode

ANALOG SIGNALS

POWER FLAGS

PWR_FLAG PWR_FLAG

GNDS3 GNDS4

TEST POINTS

3V3 TP5 Test point

Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaoclaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

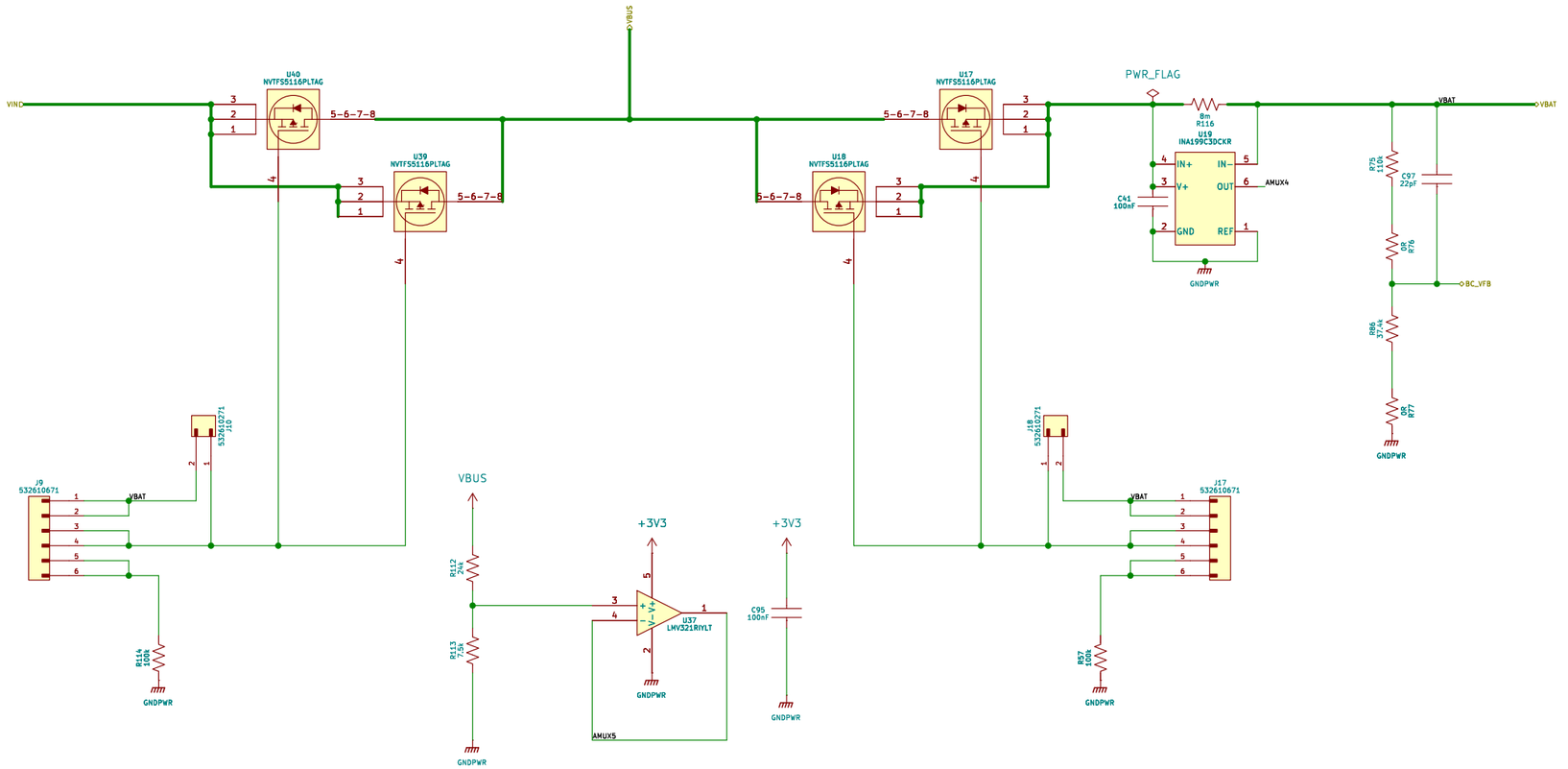
SPACELAB

Sheet: /U_3V3_Load_Converters/
File: 3V3_Load_Converters.kicad_sch

Title: Reliability Enhanced Electrical Power System

Size: A3 | Date: 2023-08-03 | **Rev: v0.0**

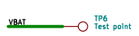
KiCad E.D.A. 8.0.4 | Id: 5/8



ANALOG SIGNALS

POWER FLAGS

TEST POINTS



Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaoclaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

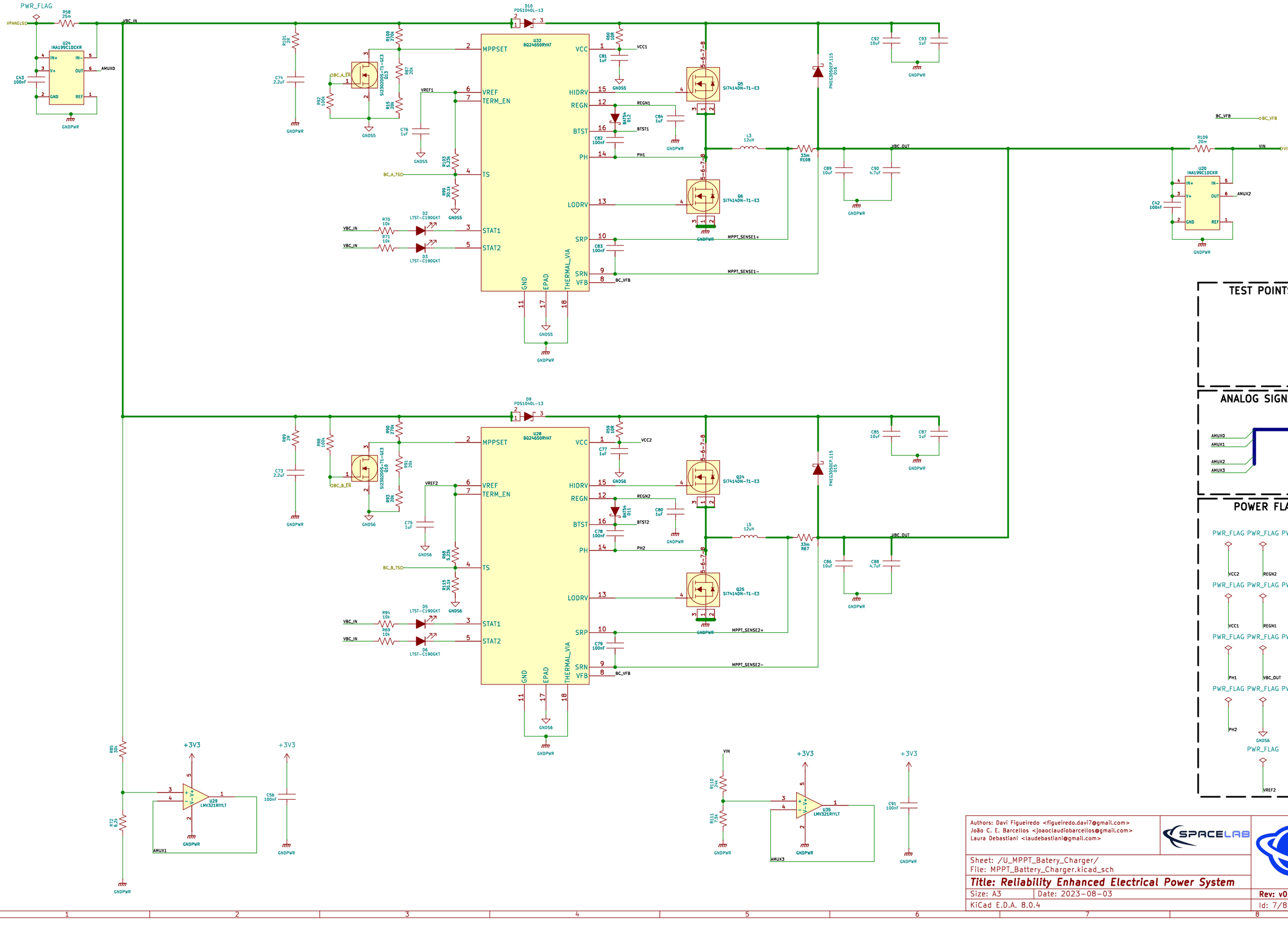
SPACELAB

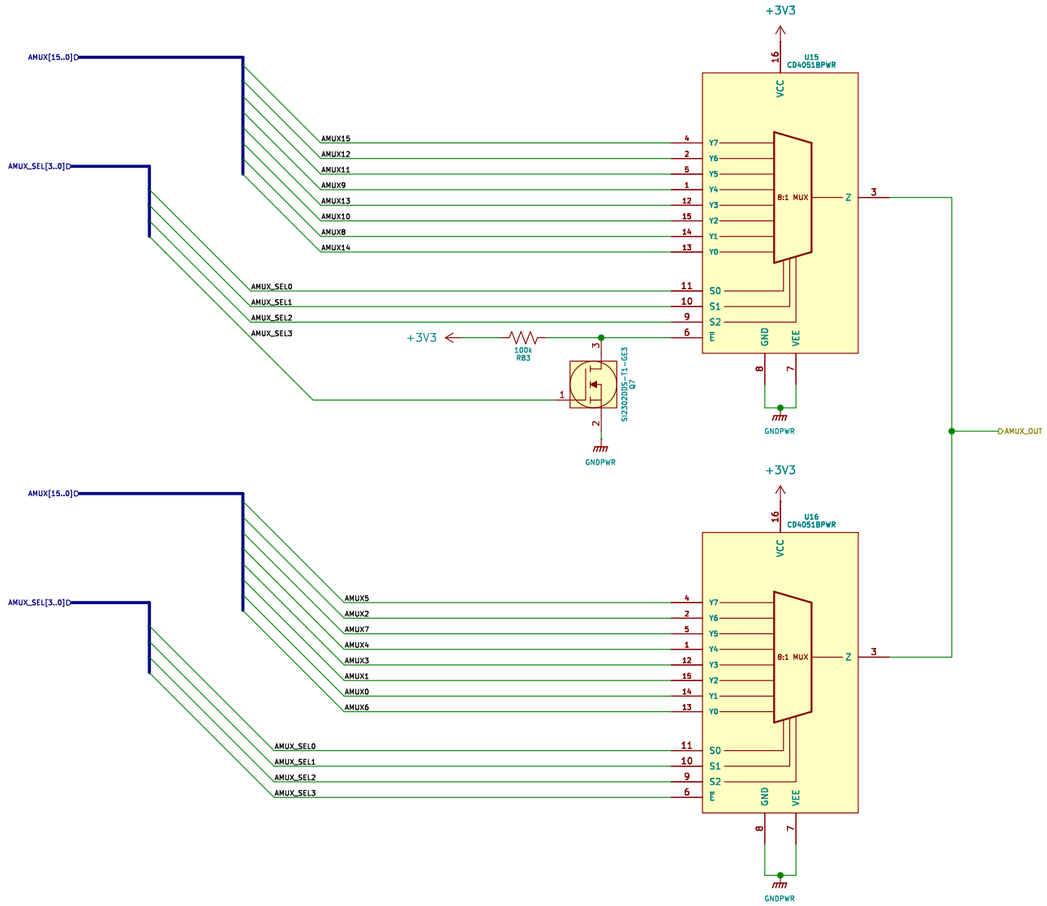
Sheet: /U_Energy Distribution/
File: Energy_Distribution.kicad_sch

Title: Reliability Enhanced Electrical Power System

Size: A3 | Date: 2023-08-03 | **Rev: v0.0**

KiCad E.D.A. 8.0.4 | Id: 6/8


PWR_FLAG
VPANELSD
R58 25m
VBC_IN
U24 INA199C1DCKR
IN+
IN−
V+
OUT
GND
REF
AMUX0
C43 100nF
GNDPWR
D10 PDS1040L-13
R101 2M
C74 2.2uF
R100 270k
R87 20k
R92 100k
SQ2302DDS-T1-GE3
BC_A_EN
R15 20k
GNDS5
VREF1
C76 1uF
R103 5.1M
BC_A_TSD
R93 324k
U32 BQ24650RVAT
MPPSET
VREF
TERM_EN
TS
STAT1
STAT2
VCC
HIDRV
REGN
BTST
PH
LODRV
SRP
SRN
VFB
THERMAL_VIA
GND
EPAD
R60 10R
VCC1
C81 1uF
GNDS5
REGN1
BAT54 D12
C84 1uF
BTST1
C82 100nF
PH1
C83 100nF
MPPT_SENSE1+
MPPT_SENSE1−
BC_VFB
Q5 SI7414DN-T1-E3
Q6 SI7414DN-T1-E3
L3 12uH
R108 33m
PMEG3050EP,115 D16
C92 10uF
C93 1uF
C89 10uF
C90 4.7uF
VBC_OUT
R70 10k
R71 10k
D2 LTST-C190GKT
D3 LTST-C190GKT
BC_VFB
R109 20m
VIN
U20 INA199C1DCKR
AMUX2
C42 100nF
D9 PDS1040L-13
R89 2M
C73 2.2uF
R90 270k
R91 20k
R92 100k
R93 20k
C75 1uF
R94 10k
R69 10k
D5 LTST-C190GKT
D6 LTST-C190GKT
R59 10R
VCC2
C77 1uF
REGN2
BAT54 D11
C80 1uF
BTST2
C78 100nF
PH2
C79 100nF
Q24 SI7414DN-T1-E3
Q25 SI7414DN-T1-E3
L5 12uH
R67 33m
PMEG3050EP,115 D15
C85 10uF
C87 1uF
C86 10uF
C88 4.7uF
R85 10R
R72 10k
U29 LMV321RIYLT
AMUX1
C56 100nF
+3V3
R110 24k
R111 7.5k
U35 LMV321RIYLT
AMUX3
C91 100nF
TEST POINTS
ANALOG SIGNALS
AMUX0
AMUX1
AMUX2
AMUX3
AMUX[3..0]
POWER FLAGS
PWR_FLAG
VCC2
REGN2
BTST2
VCC1
REGN1
BTST1
PH1
VBC_OUT
VREF1
PH2
GNDS6
GNDS5
VREF2
Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaoclaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>
SPACELAB
Sheet: /U_MPPT_Batery_Charger/
File: MPPT_Battery_Charger.kicad_sch
Title: Reliability Enhanced Electrical Power System
Size: A3
Date: 2023-08-03
KiCad E.D.A. 8.0.4
Rev: v0.0
Id: 7/8



LOOK-UP TABLE

AMUX_SEL[0..3] [3][2][1][0]	AMUX_OUT	Parameter
0 0 0 0	AMUX6	Current In VBUS_BK5V0
0 0 0 1	AMUX0	Current In VPANELS
0 0 1 0	AMUX1	Voltage In VPANELS
0 0 1 1	AMUX3	Voltage In VIN
0 1 0 0	AMUX4	Current In VBAT
0 1 0 1	AMUX7	Current In VBUS_BK3V3
0 1 1 0	AMUX2	Current In VIN
0 1 1 1	AMUX5	Voltage In VBUS
1 0 0 0	AMUX14	Current In 3V3_OBDH
1 0 0 1	AMUX8	Current In 5V0_Payload
1 0 1 0	AMUX10	Current In 5V0_RadioBeacon
1 0 1 1	AMUX13	Current In 3V3_Beacon
1 1 0 0	AMUX9	Current In 5V0_RadioMain
1 1 0 1	AMUX11	Voltage In 5V0
1 1 1 0	AMUX12	Current In 3V3_AntDep
1 1 1 1	AMUX15	Voltage In 3V3

OBSERVATIONS

In order to facilitate the development of the PCB, the position of the AMUX_OUT[0..15] signals has not been put in sequence, as can be seen in the table above. This will be resolved in a future version. An issue has already been created to resolve this (Issue #21).

Authors: Davi Figueiredo <figueiredo.davi7@gmail.com>
João C. E. Barcellos <joaociaudiobarcellos@gmail.com>
Laura Debastiani <laudebastiani@gmail.com>

SPACELAB

Sheet: /U_House_Keeping/
File: House_Keeping.kicad_sch

Title: Reliability Enhanced Electrical Power System

Size: A3 | Date: 2023-08-03 | **Rev: v0.0**

KiCad E.D.A. 8.0.4 | Id: 8/8