

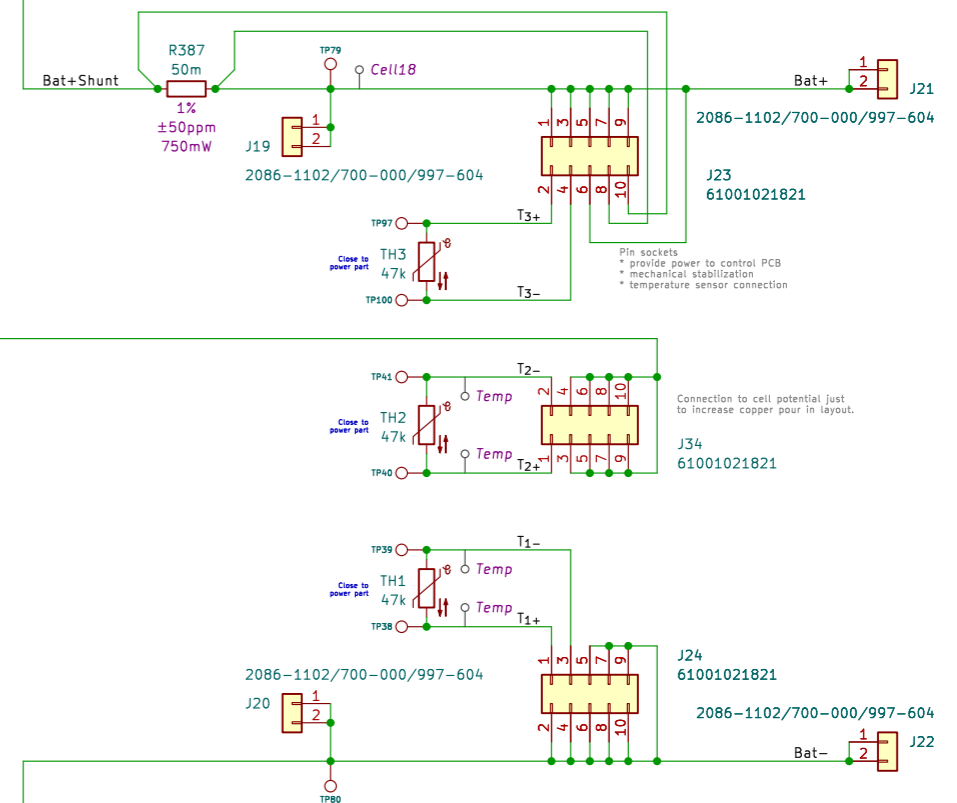
Do not connect grounds on the output side (possibility of circular currents with control board).

Instructions and notes

- Provide a current limited (!) supply with max. voltage ≤ 80 V to the supply terminals. The connected BMS can be supplied using the Bat+/- terminals.
- The max. current through cell voltage stack is 1 A (if cooling is sufficient).
- Set the power supply's current limit as low as possible to reduce power dissipation. A good starting point is the BMS's max. cell balancing current +50..100 mA (self-supply and regulation headroom).
- +the active-mode supply current of a connected BMS.
- It is possible to operate less than the max. number of cell voltage outputs. Unused ones must be shorted to make sure the stack's top voltage equals the sum of the cell voltages. Mind the UVLO of the CVTCS-C supply (≈ 18 V).
- Temperature outputs must _not_ be shorted in any case.

ATTENTION

Observe to the power transistors's temperatures closely. There is _no_ hardware over-temperature protection! (This would potentially create high cell voltages which in turn destroyed connected BMSs.)



H1	H2	H3	H4	H5	H6	FID1	FID2	FID3
MountingHole:MountingHole_4.5mm						Fiducial:Fiducial_L1mm_Mask2mm		

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /
File: cvtcs-p.kicad_sch

CERN-OHL-S
2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

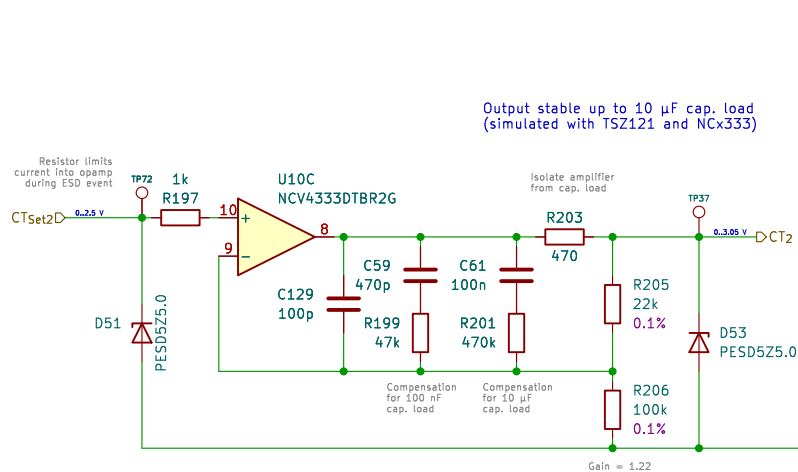
Size: A3

Date: 2025-07-29

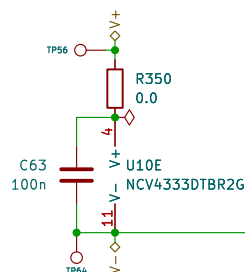
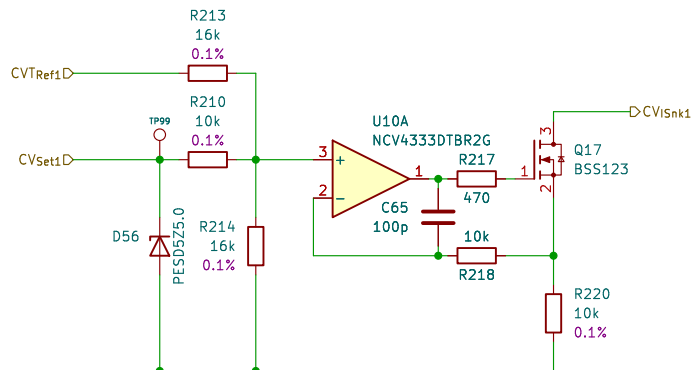
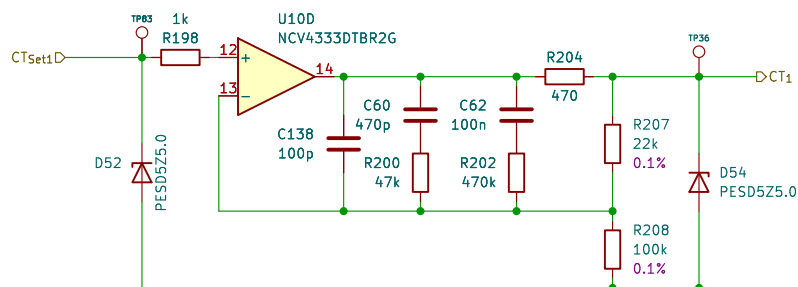
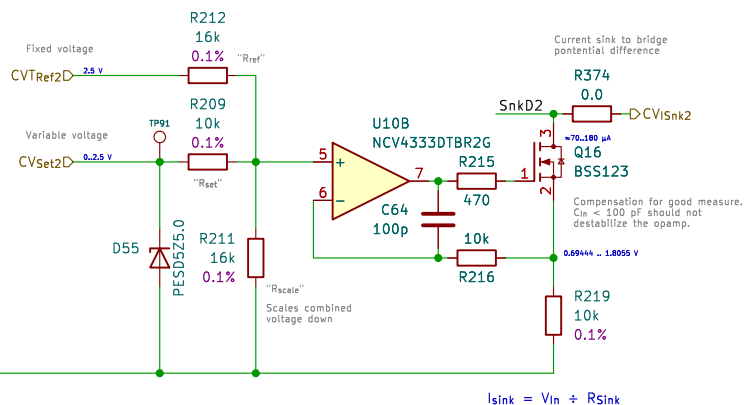
Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 1/29



Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTctrl9/
 File: cvtctrl2.kicad_sch

CERN-OHL-S
 2.0

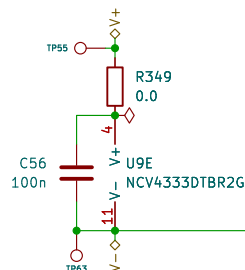
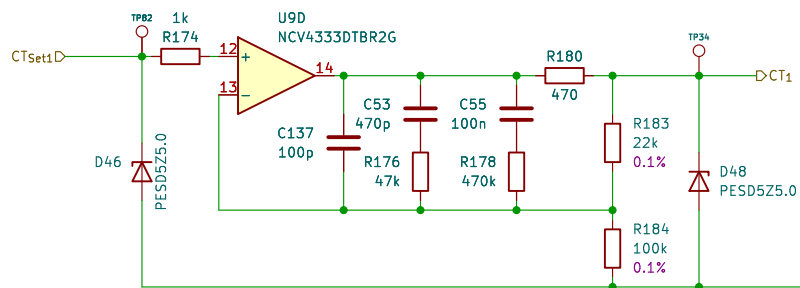
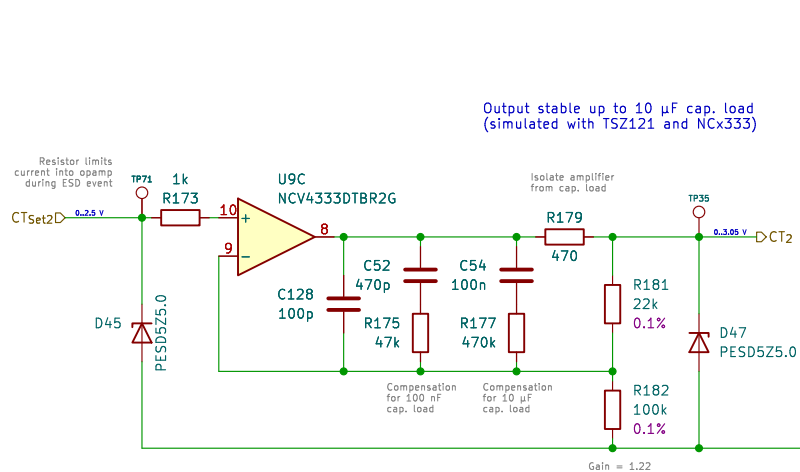
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A4 Date: 2025-07-29

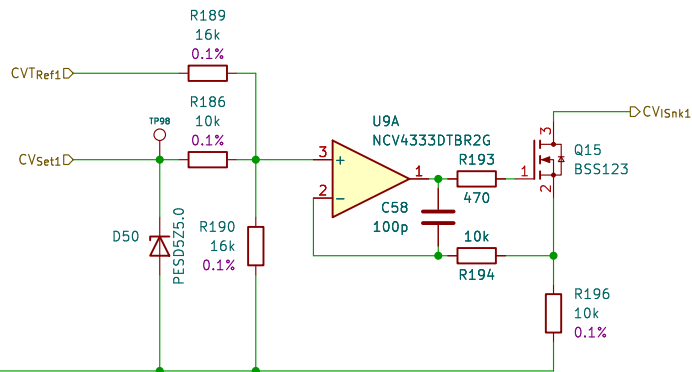
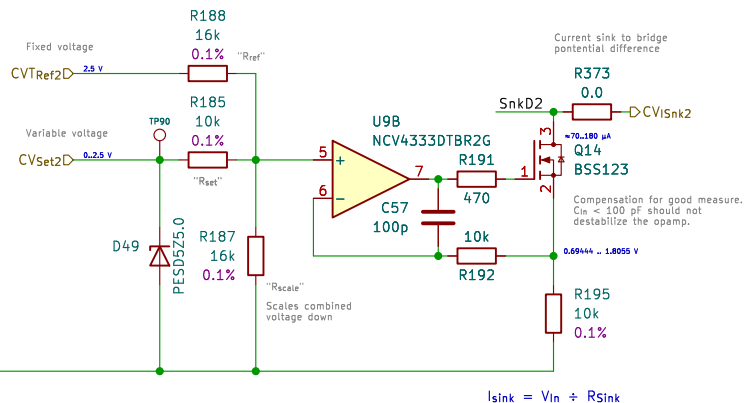
Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 11/29



Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTctrl8/
 File: cvtctrl2.kicad_sch

CERN-OHL-S
 2.0

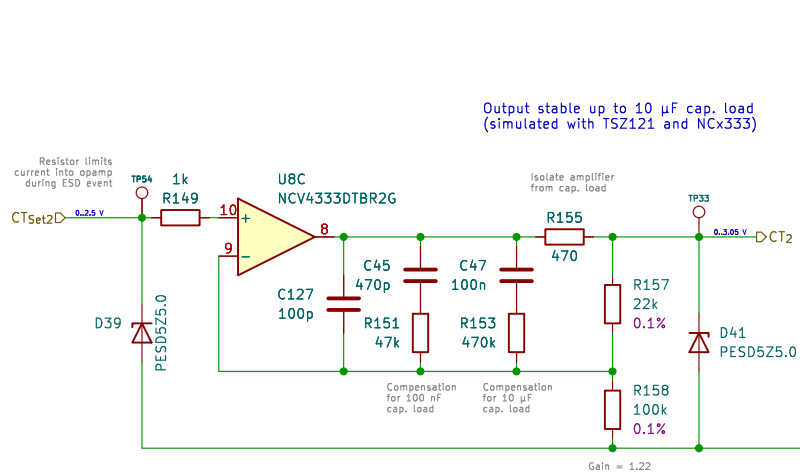
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A4 Date: 2025-07-29

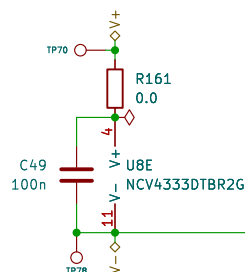
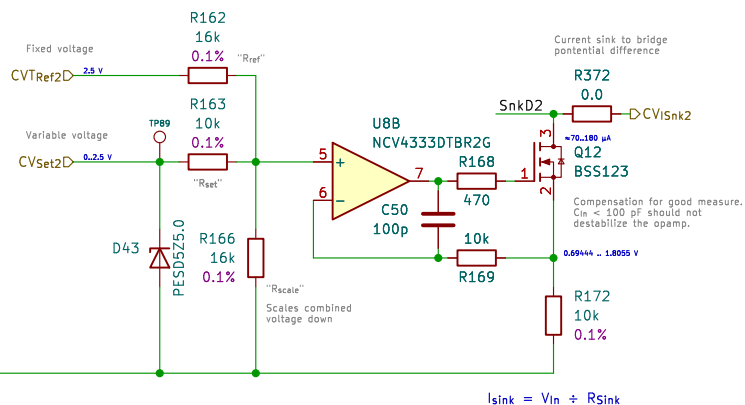
Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 10/29



Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTCtrl7/
 File: cvtctrl2.kicad_sch

CERN-OHL-S
 2.0

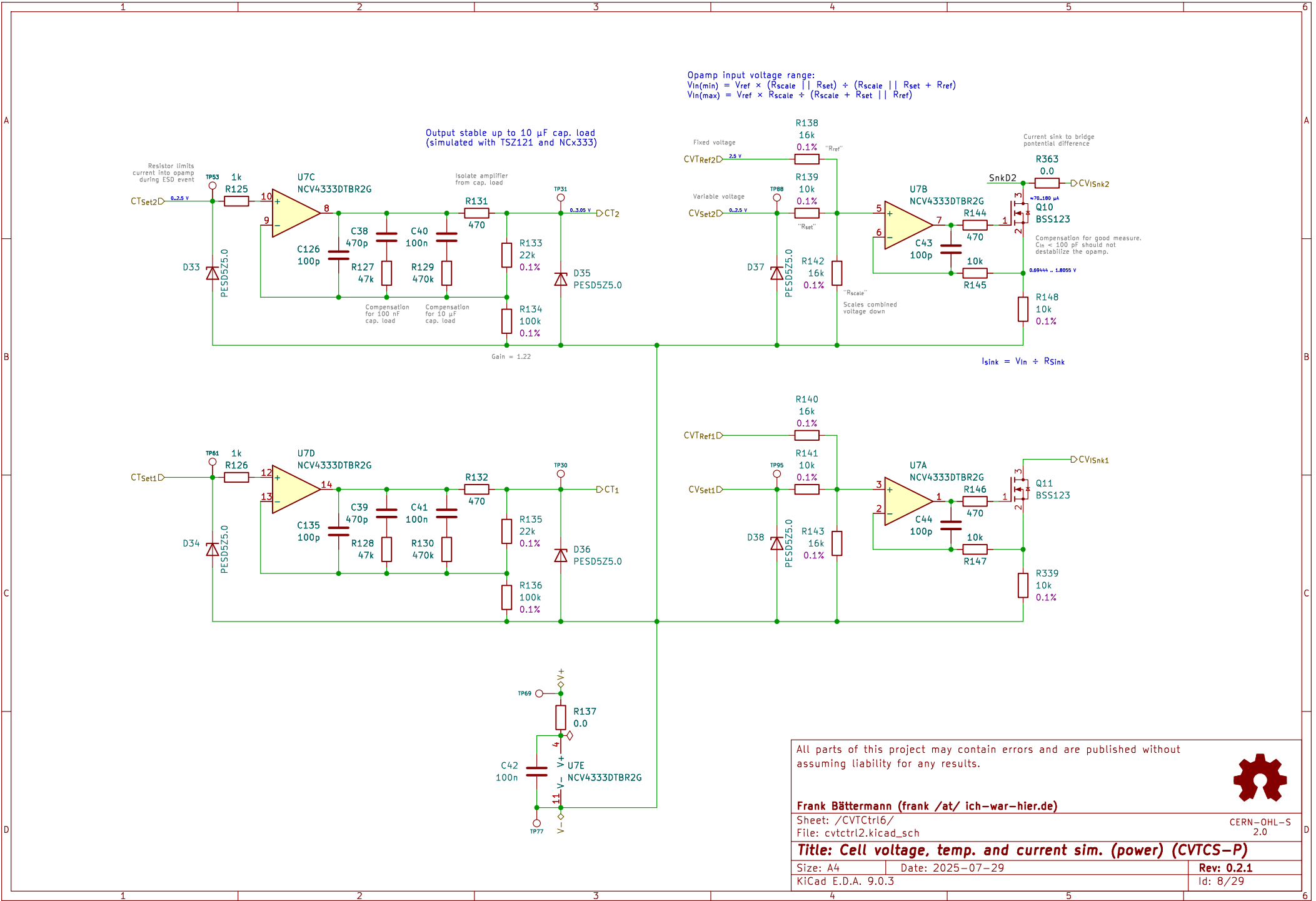
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A4 Date: 2025-07-29

Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 9/29



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTCtrl6/
File: cvtctrl2.kicad_sch

CERN-OHL-S
2.0

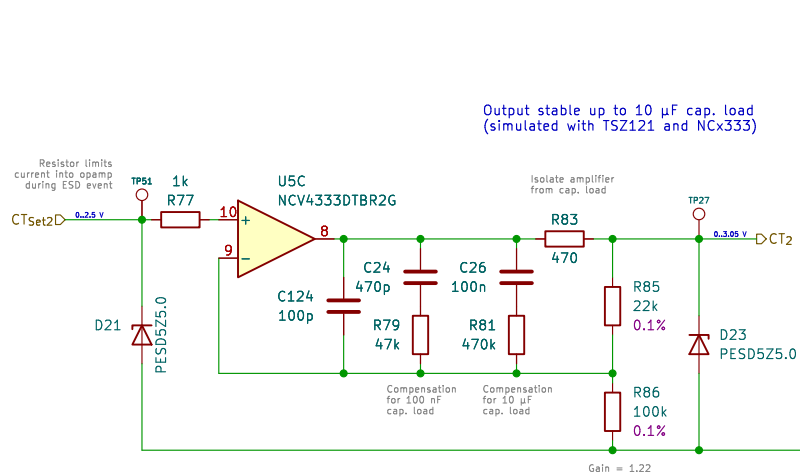
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A4 Date: 2025-07-29

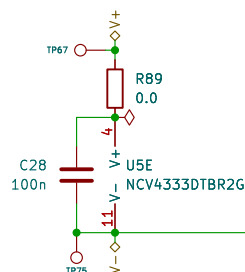
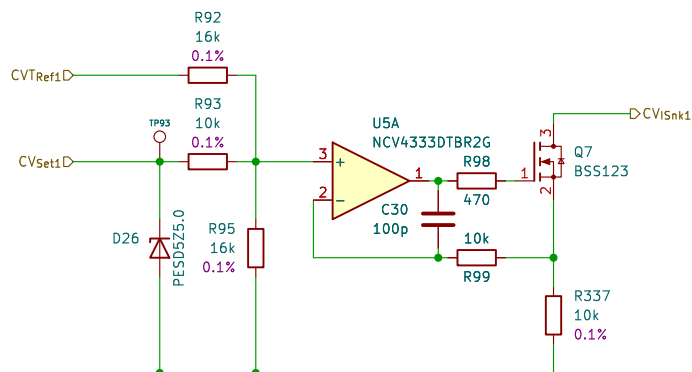
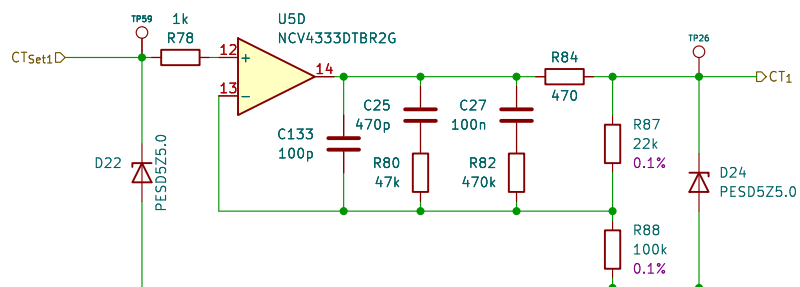
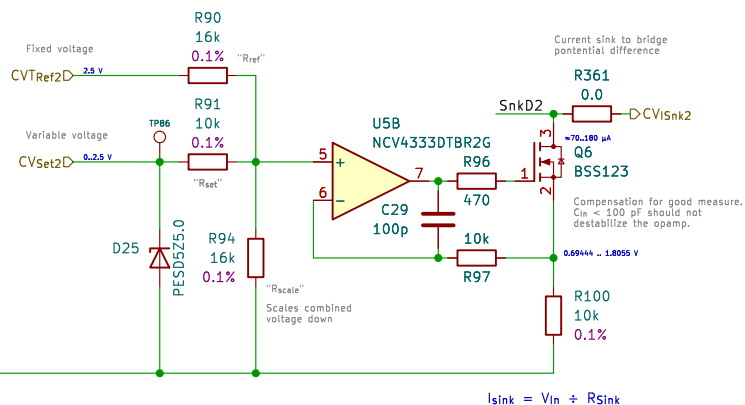
Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 8/29



Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTctrl4/
 File: cvtctrl2.kicad_sch

CERN-OHL-S
 2.0

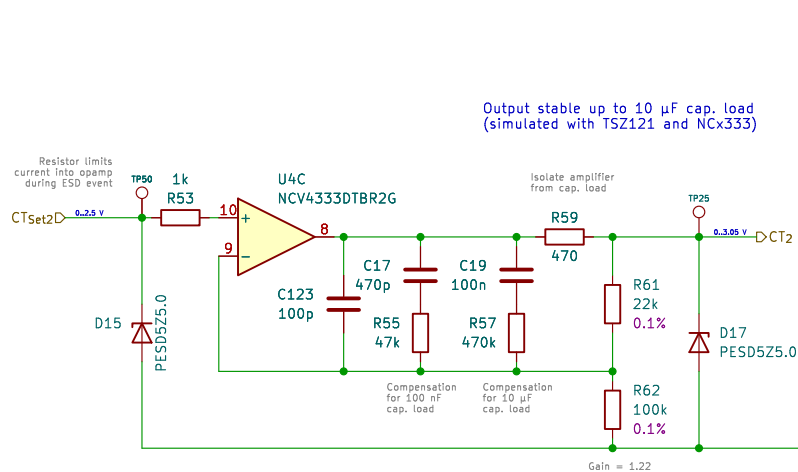
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A4 Date: 2025-07-29

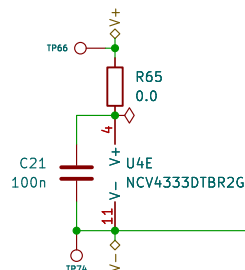
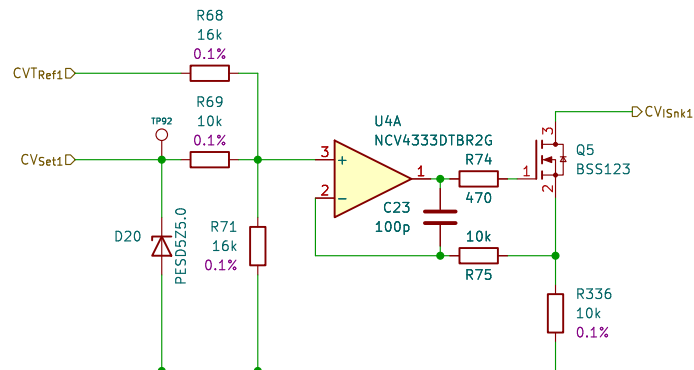
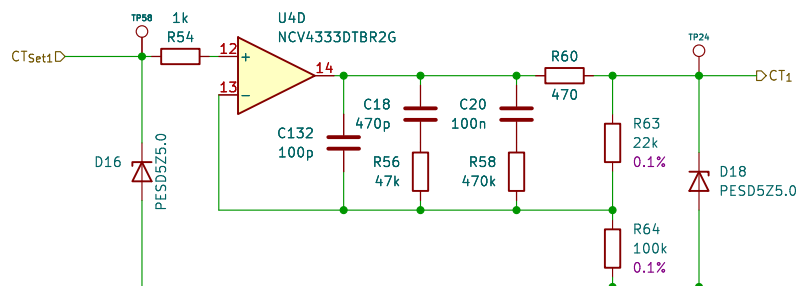
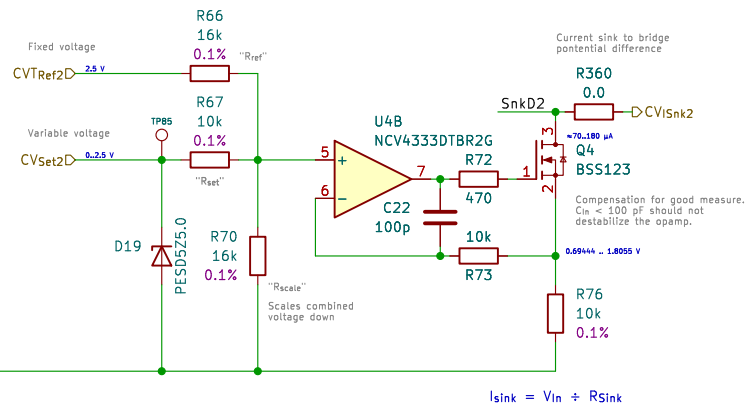
Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 6/29



Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTCtrl3/
 File: cvtctrl2.kicad_sch

CERN-OHL-S
 2.0

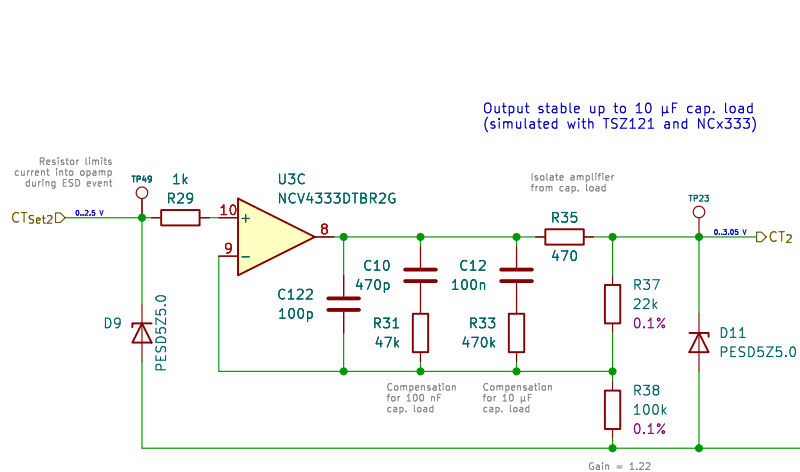
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A4 Date: 2025-07-29

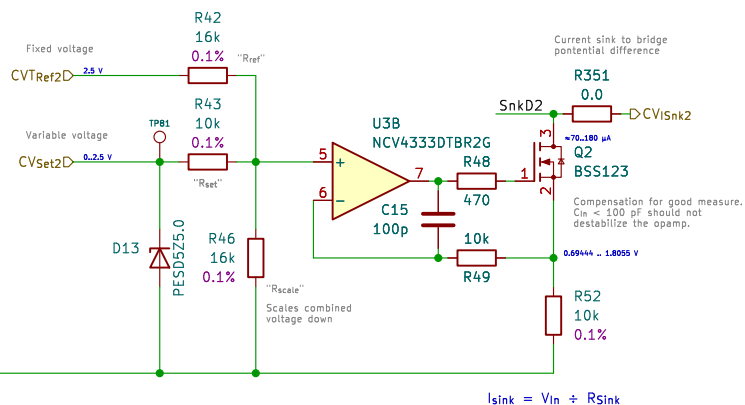
Rev: 0.2.1

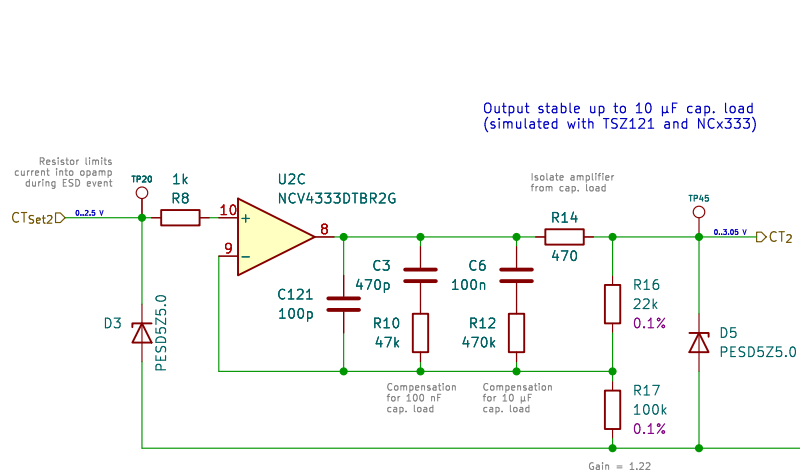
KiCad E.D.A. 9.0.3

Id: 5/29

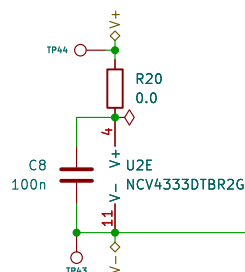
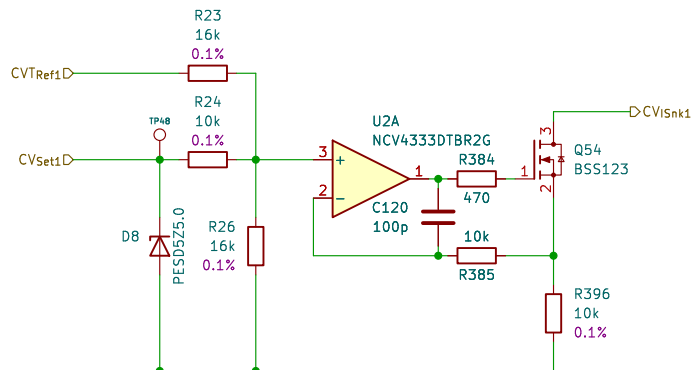
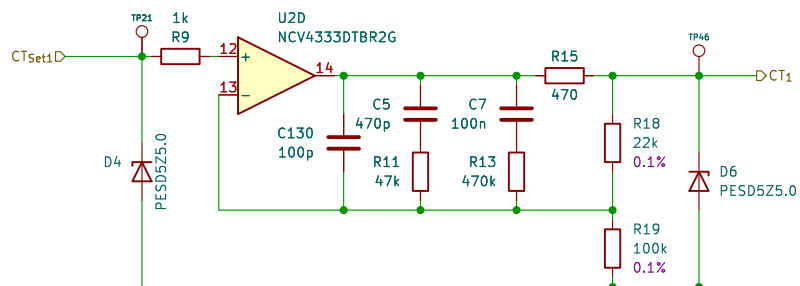
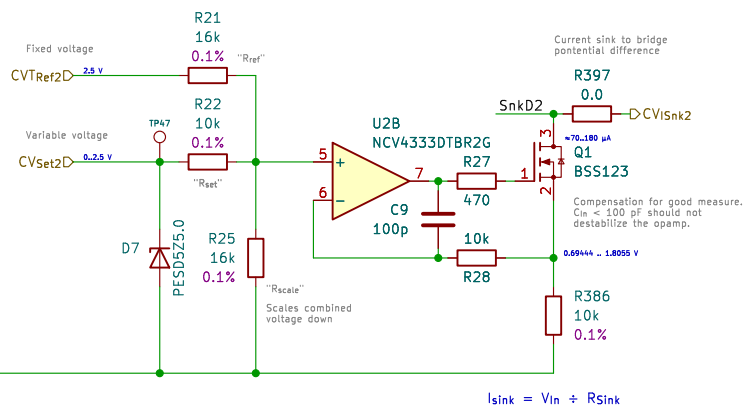


Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$





Opamp input voltage range:
 $V_{in(min)} = V_{ref} \times (R_{scale} \parallel R_{set}) \div (R_{scale} \parallel R_{set} + R_{ref})$
 $V_{in(max)} = V_{ref} \times R_{scale} \div (R_{scale} + R_{set} \parallel R_{ref})$



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ Ich-war-hier.de)

Sheet: /CVTCtrl1/
 File: cvtctrl2.kicad_sch

CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

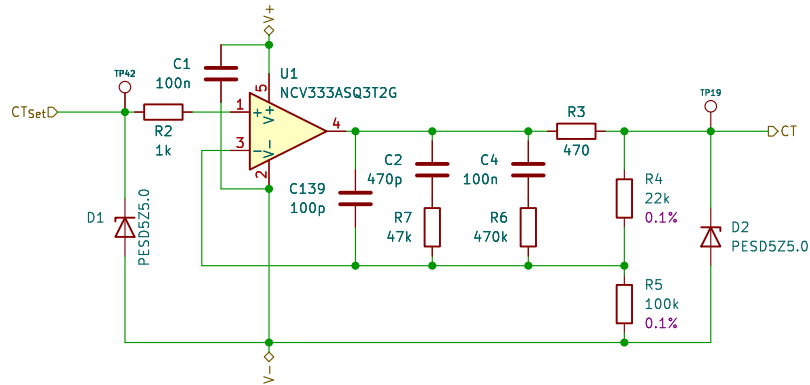
Size: A4 Date: 2025-07-29

Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 3/29

For notes and comments refer to CVTCtrl1.



All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CTCtrl0/
File: ctctrl0.kicad_sch

CERN-OHL-S
2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

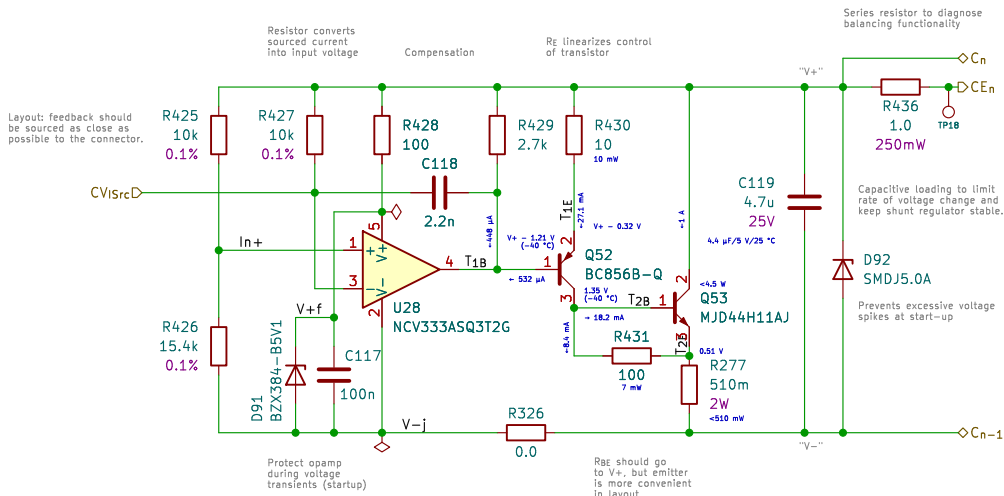
Size: A5

Date: 2025-07-29

Rev: 0.2.1

KiCad E.D.A. 9.0.3

Id: 2/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr18/
 File: cvpwr2.kicad_sch

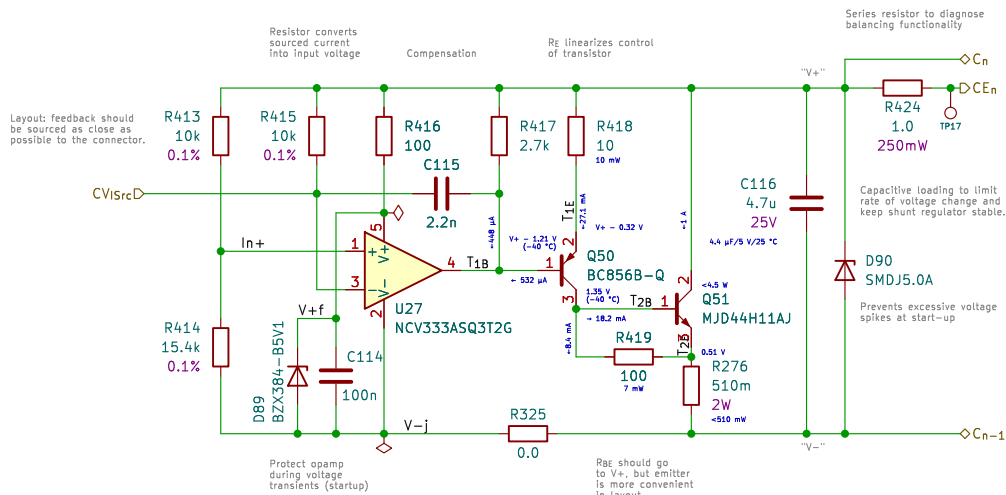
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 29/29



Voltage range (with $V_{in} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{in} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr17/
 File: cvpwr2.kicad_sch

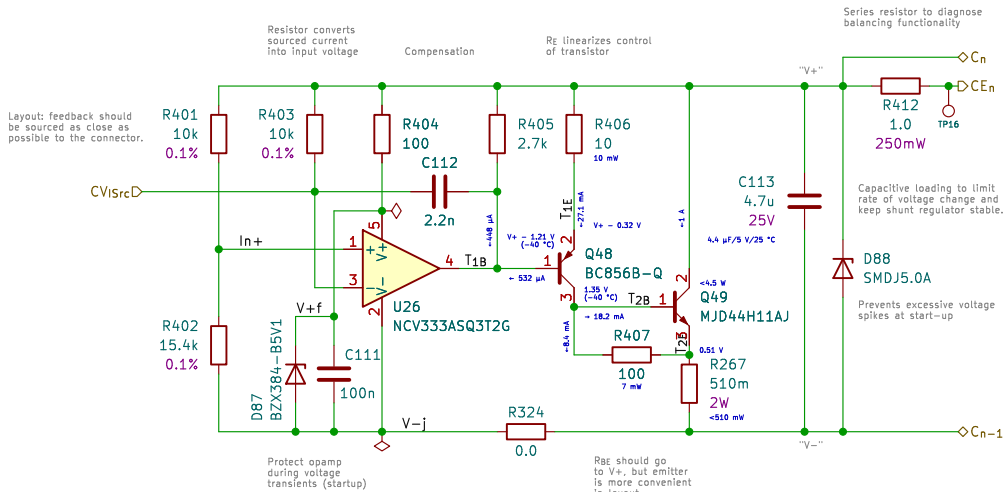
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 28/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr16/
 File: cvpwr2.kicad_sch

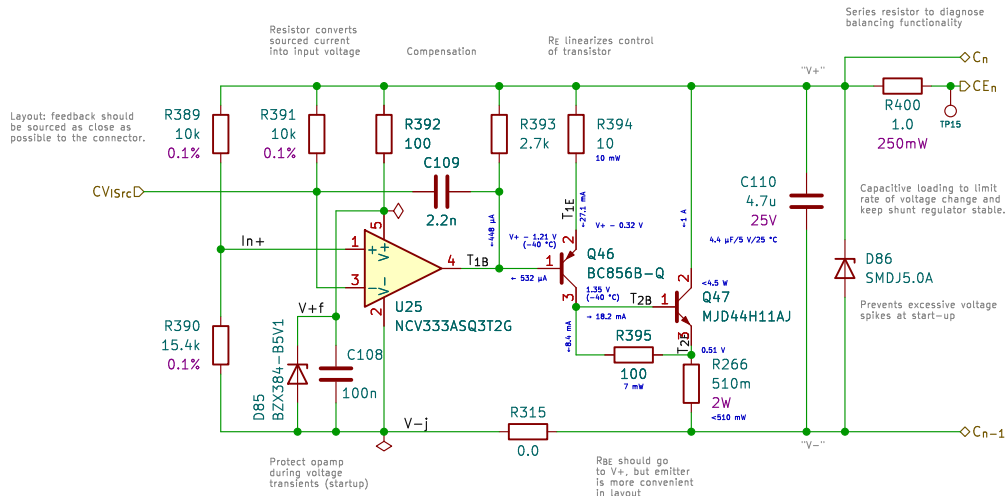
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 27/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr15/
 File: cvpwr2.kicad_sch

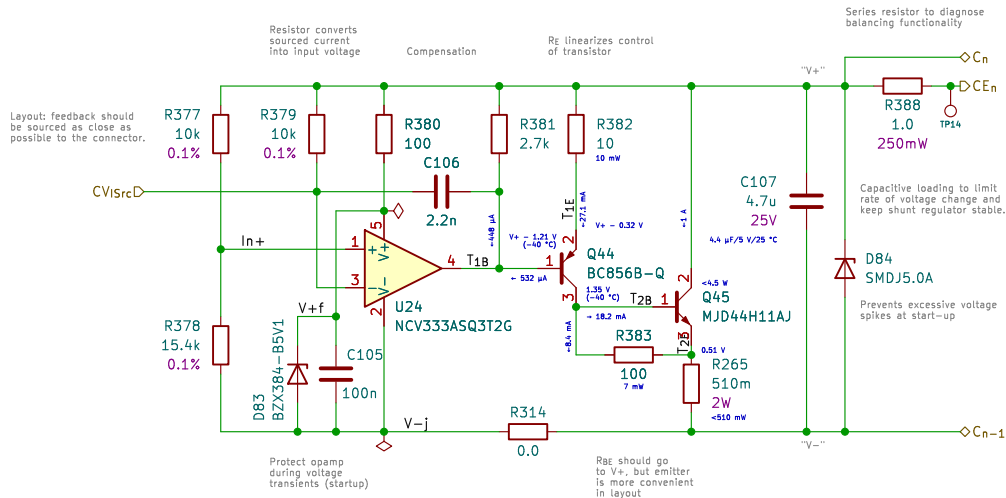
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 26/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/JMD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

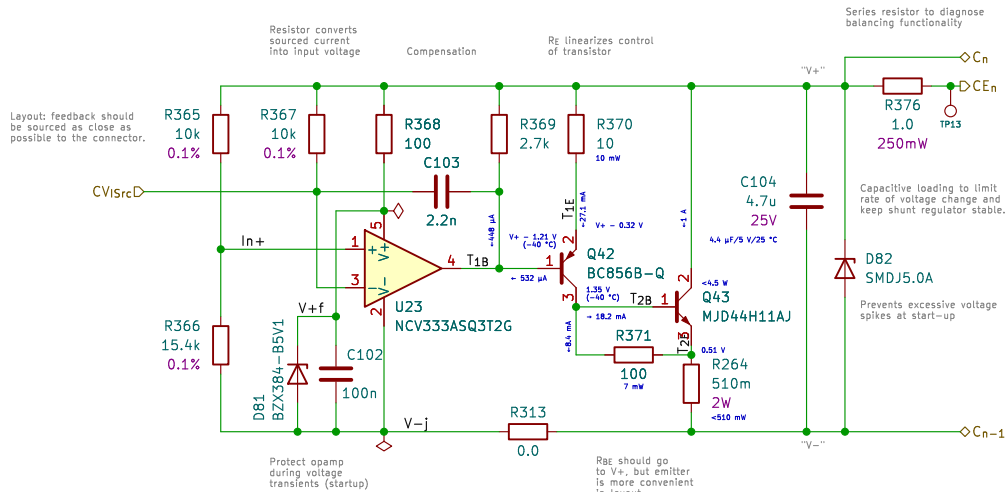
Sheet: /CVPwr14/
 File: cvpwr2.kicad_sch

CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 Date: 2025-07-29
 KiCad E.D.A. 9.0.3

Rev: 0.2.1
 Id: 25/29



Voltage range (with $V_{in} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{in} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr13/
 File: cvpwr2.kicad_sch

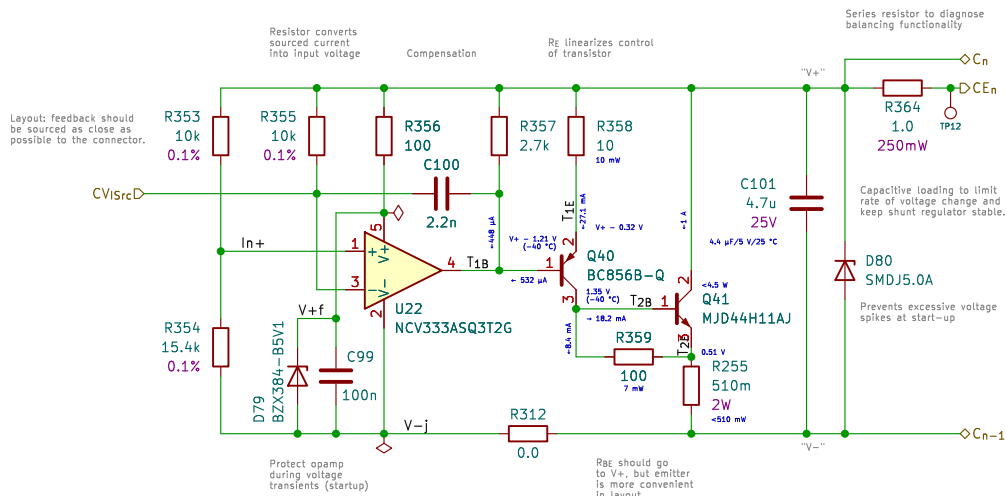
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 24/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr12/
 File: cvpwr2.kicad_sch

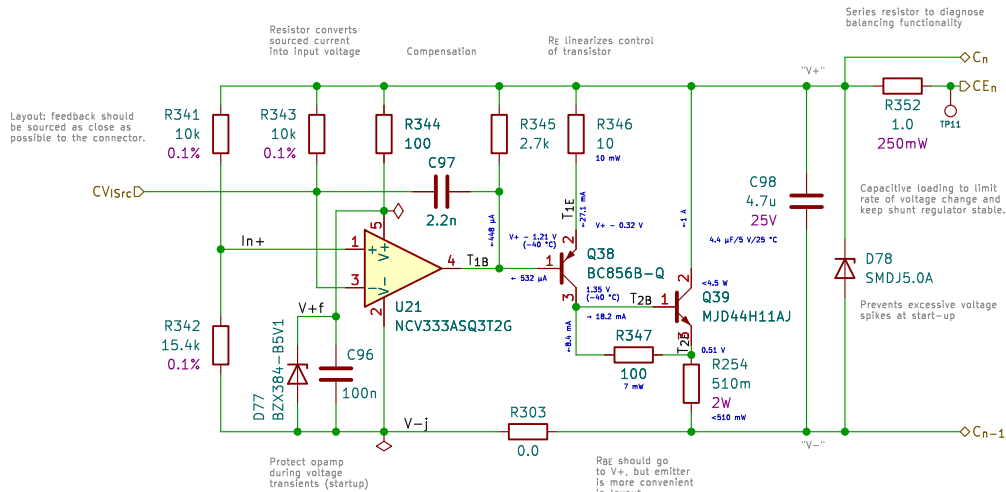
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 23/29



Voltage range (with $V_{in} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{in} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/JMD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr11/
 File: cvpwr2.kicad_sch

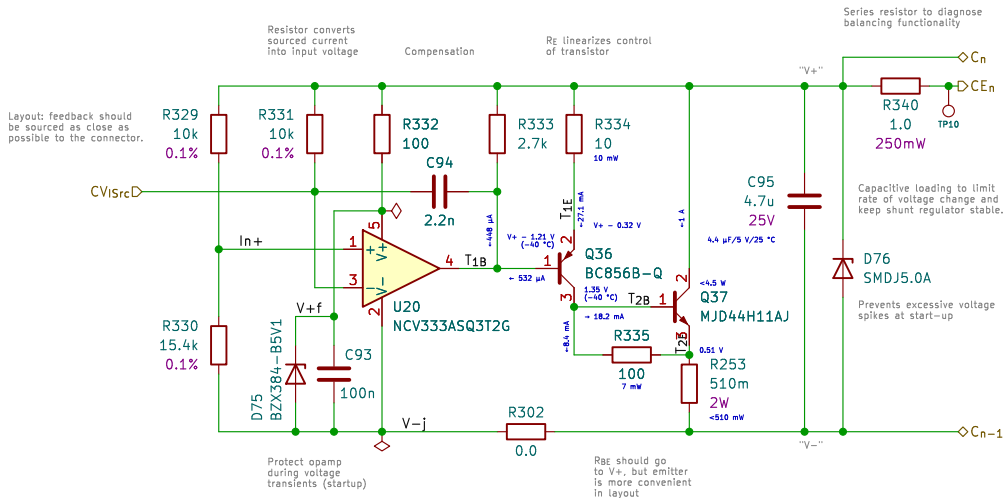
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 22/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/MJD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr10/
 File: cvpwr2.kicad_sch

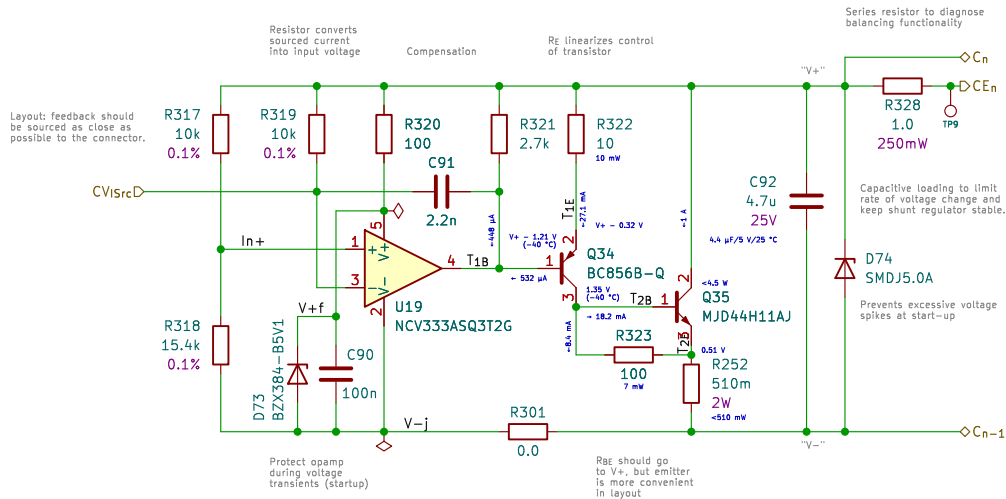
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 21/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μ m thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40 °C is $h_{FE} = 50$
 $V_{CE(sat)} = 110$ mV/40 mA/-40 °C

Nexperia MJD44H11AJ/MJD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40 °C is $h_{FE} = 55$
 $V_{CE(sat)} = 750$ mV/1 A/-40 °C

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr9/
 File: cvpwr2.kicad_sch

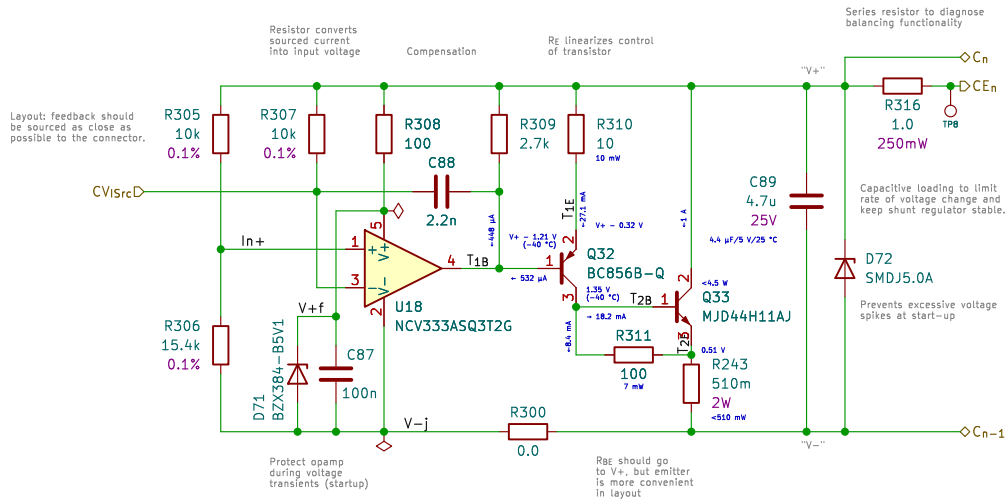
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 20/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/JMD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr8/
 File: cvpwr2.kicad_sch

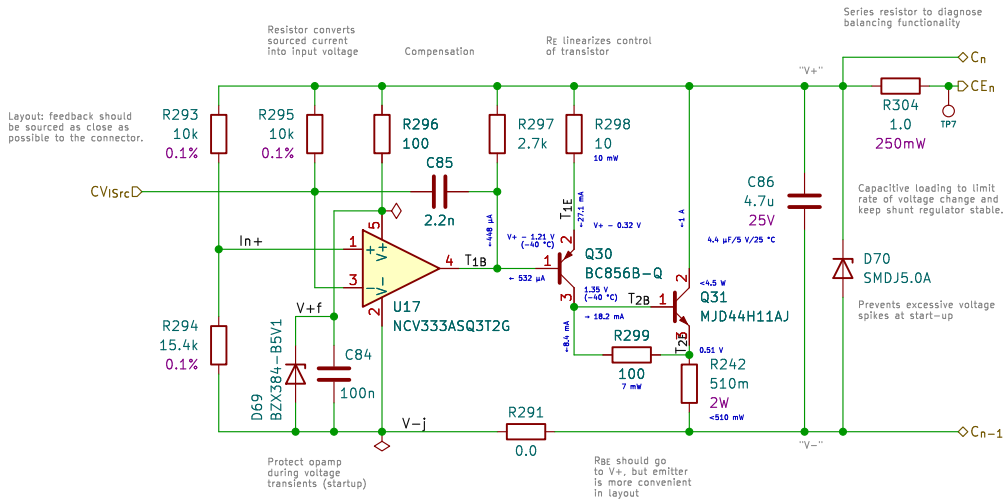
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 19/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11AJ/MJD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr7/
 File: cvpwr2.kicad_sch

CERN-OHL-S
 2.0

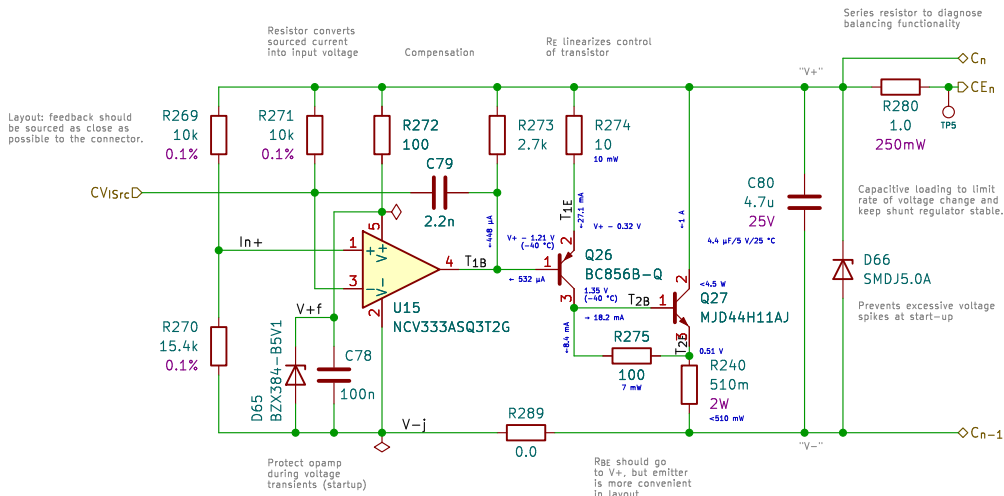
Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 18/29

Id: 17/29



Voltage range (with $V_{in} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{in} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40 °C is $h_{FE} = 50$
 $V_{CE(sat)} = 110$ mV/40 mA/-40 °C

Nexperia MJD44H11A/JMD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40 °C is $h_{FE} = 55$
 $V_{CE(sat)} = 750$ mV/1 A/-40 °C

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr5/
 File: cvpwr2.kicad_sch

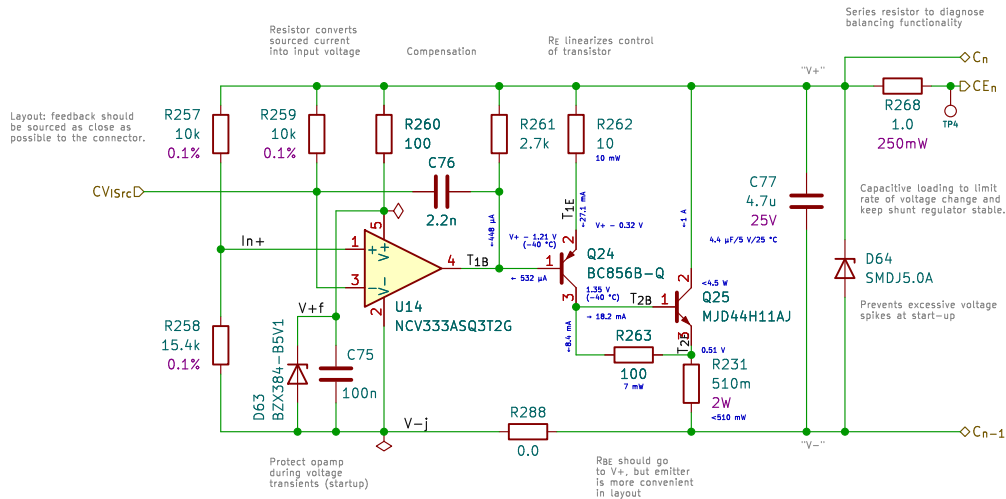
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 16/29



Voltage range (with $V_{in} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{in} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/JMD45H11A:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr4/
 File: cvpwr2.kicad_sch

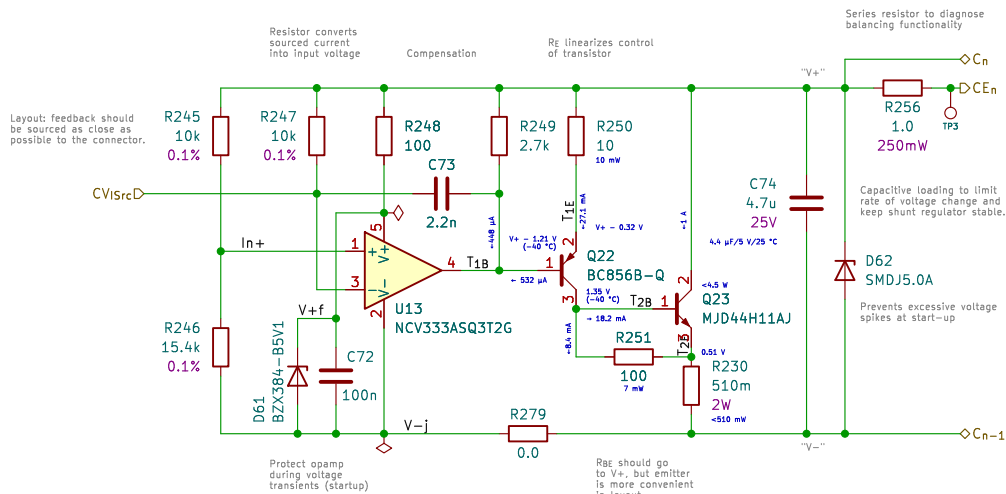
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 15/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11AJ/MJD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr3/
 File: cvpwr2.kicad_sch

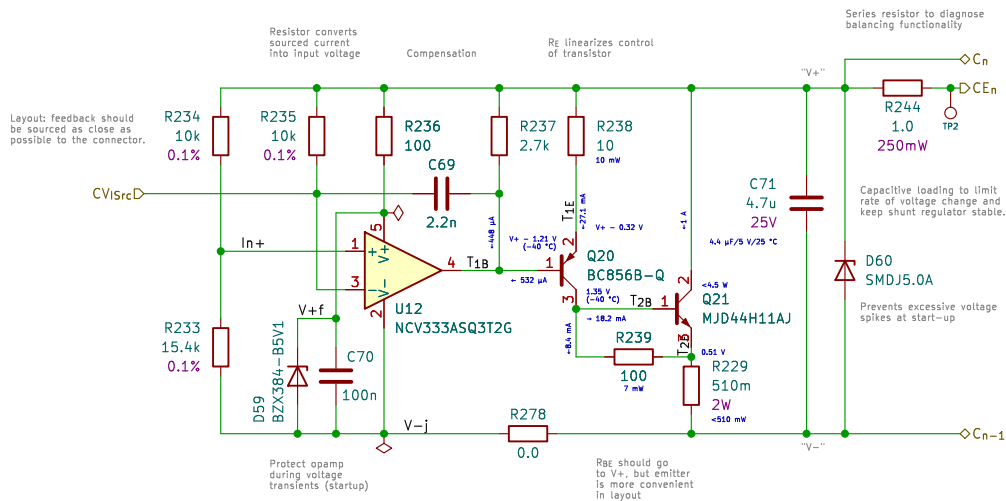
CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 14/29



Voltage range (with $V_{IN} \approx 0.694..1.81$ V): 1.76..4.60 V
 $V_+ - V_- = V_{IN} \times (15.4 \text{ k}\Omega + 10 \text{ k}\Omega + 1)$

A copper track 0.2 wide, 25 μm thick (0.005 mm²) and 50 mm long is a ca. 172/217 mR at 25/85 °C. So even a few mA supply current would lead to noticable voltage output errors.

Nexperia BC846B/BC856B:
 $h_{FE} \geq 220$ at 2 mA/5 V/25 °C (= 65% of typical value)
 65% of typical value at 35 mA/-40°C is $h_{FE} = 50$
 $V_{CE(sat)} = 110 \text{ mV}/40 \text{ mA}/-40 \text{ °C}$

Nexperia MJD44H11A/JMD45H11AJ:
 $h_{FE} \geq 60$ at 2 A/1 V/25 °C (= 40% of typical value)
 40% of typical value at 1 A/-40°C is $h_{FE} = 55$
 $V_{CE(sat)} = 750 \text{ mV}/1 \text{ A}/-40 \text{ °C}$

All parts of this project may contain errors and are published without assuming liability for any results.



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet: /CVPwr2/
 File: cvpwr2.kicad_sch

CERN-OHL-S
 2.0

Title: Cell voltage, temp. and current sim. (power) (CVTCS-P)

Size: A5
 KiCad E.D.A. 9.0.3

Date: 2025-07-29

Rev: 0.2.1
 Id: 13/29

