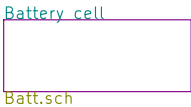
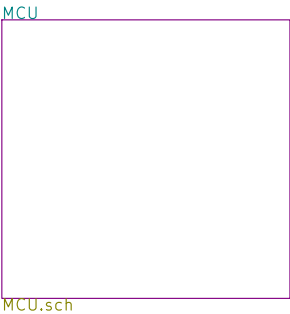
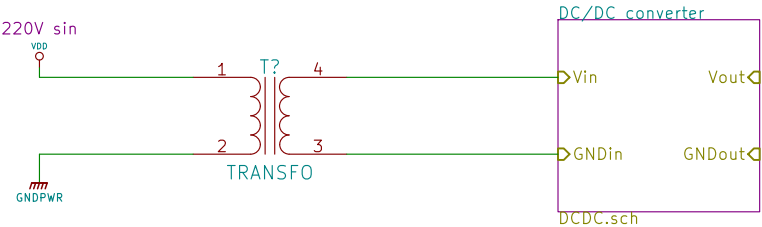
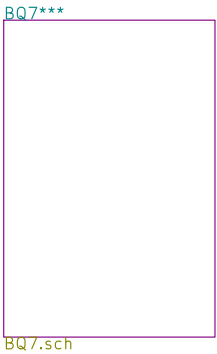
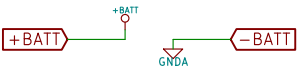


This is start of BMS it made of 4 components first is transformator from 220V/100V and graetz.
Next is DC/DC converter with variable currnet and voltage.(this first is more a charger)
Next on every cell i bq7*** microchip with abilty to measere and balance every battery cell
(one is doing that for 15 batterys)(balance is done with discharging).
And bq7*** is controled with some mcu



FESB		
Sheet: /		
File: BMS.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 1/68

	1	2	3	4	5	6
A						
B						
C						
D						
	1	2	3	4	5	6

FESB

Sheet: /MCU/
File: MCU.sch

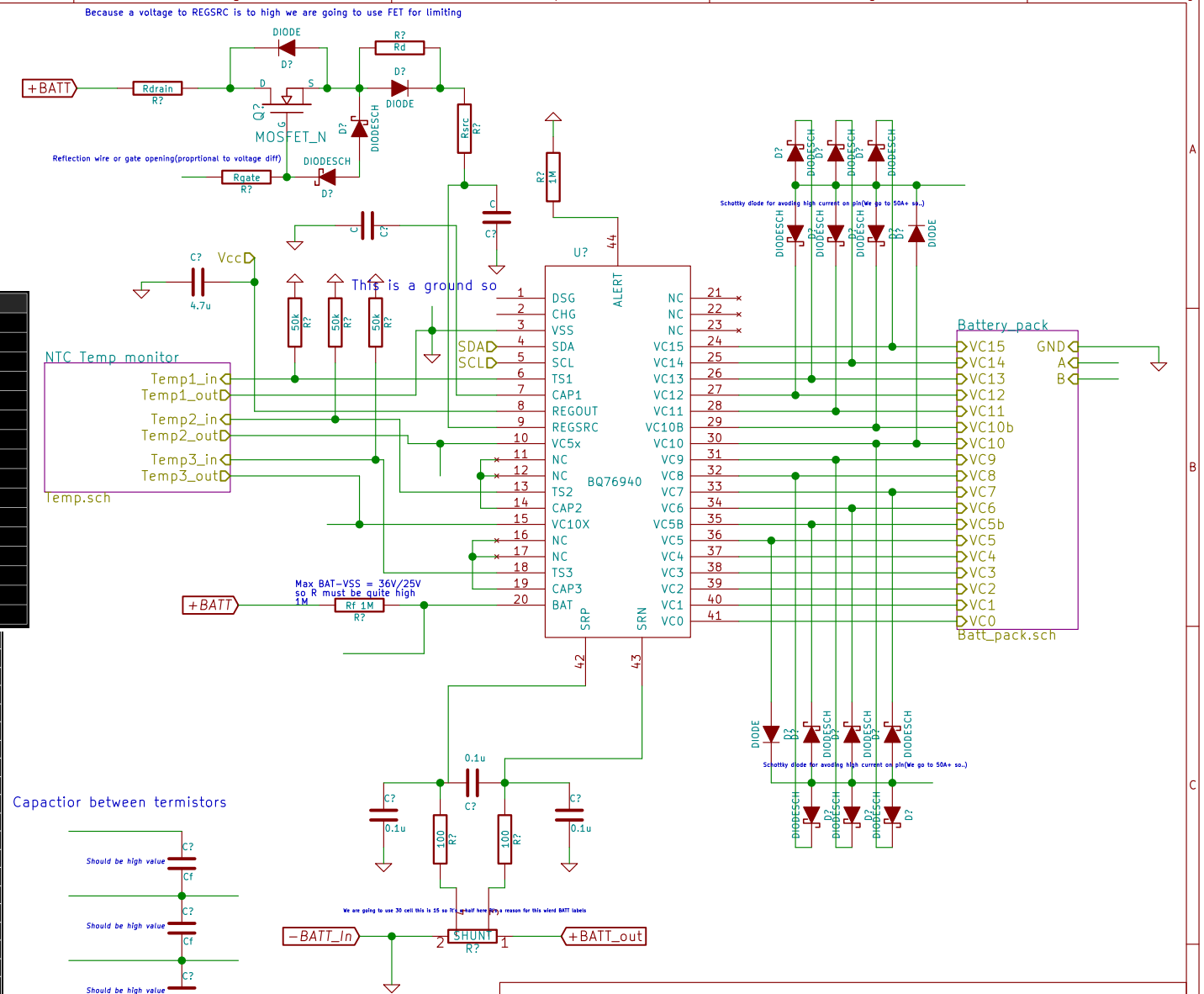
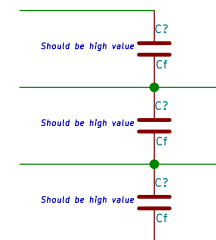
Title:

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 2/68

VSS is same as ground symbol in this sheet

PIN	NAME	TYPE	DESCRIPTION
1	DSG	O	Discharge FET driver
2	CHG	O	Charge FET driver
3	VSS	—	Chip VSS
4	SDA	I/O	I ² C communication to the host controller
5	SCL	I	I ² C communication to the host controller
6	TS1	I	Thermistor #1 positive terminal ⁽¹⁾
7	CAP1	O	Capacitor to VSS
8	REGOUT	P	Output LDO
9	REGSRC	I	Input source for output LDO
10	VC5X	P	Thermistor #2 negative terminal
11	NC	—	No connect (short to CAP2)
12	NC	—	No connect (short to CAP2)
13	TS2	I	Thermistor #2 positive terminal ⁽¹⁾
14	CAP2	O	Capacitor to VC5X
15	VC10X	P	Thermistor #3 negative terminal
16	NC	—	No connect (short to CAP3)

PIN	NAME	TYPE	DESCRIPTION
17	NC	—	No connect (short to CAP3)
18	TS3	I	Thermistor #3 positive terminal ⁽¹⁾
19	CAP3	O	Capacitor to VC10X
20	BAT	P	Battery (top-most) terminal
21	NC	—	No connect
22	NC	—	No connect
23	NC	—	No connect
24	VC15	I	Sense voltage for 15th cell positive terminal
25	VC14	I	Sense voltage for 14th cell positive terminal
26	VC13	I	Sense voltage for 13th cell positive terminal
27	VC12	I	Sense voltage for 12th cell positive terminal
28	VC11	I	Sense voltage for 11th cell positive terminal
29	VC10B	I	Sense voltage for 10th cell negative terminal
30	VC10	I	Sense voltage for 10th cell positive terminal
31	VC9	I	Sense voltage for 9th cell positive terminal
32	VC8	I	Sense voltage for 8th cell positive terminal
33	VC7	I	Sense voltage for 7th cell positive terminal
34	VC6	I	Sense voltage for 6th cell positive terminal
35	VC5B	I	Sense voltage for 6th cell negative terminal
36	VC5	I	Sense voltage for 5th cell positive terminal
37	VC4	I	Sense voltage for 4th cell positive terminal
38	VC3	I	Sense voltage for 3rd cell positive terminal
39	VC2	I	Sense voltage for 2nd cell positive terminal
40	VC1	I	Sense voltage for 1st cell positive terminal
41	VC0	I	Sense voltage for 1st cell negative terminal
42	SRP	I	Negative current sense (nearest VSS)
43	SRN	I	Positive current sense
44	ALERT	I/O	Alert output and override input



Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 3/68

Missing only for NTC so we can convert to Temp

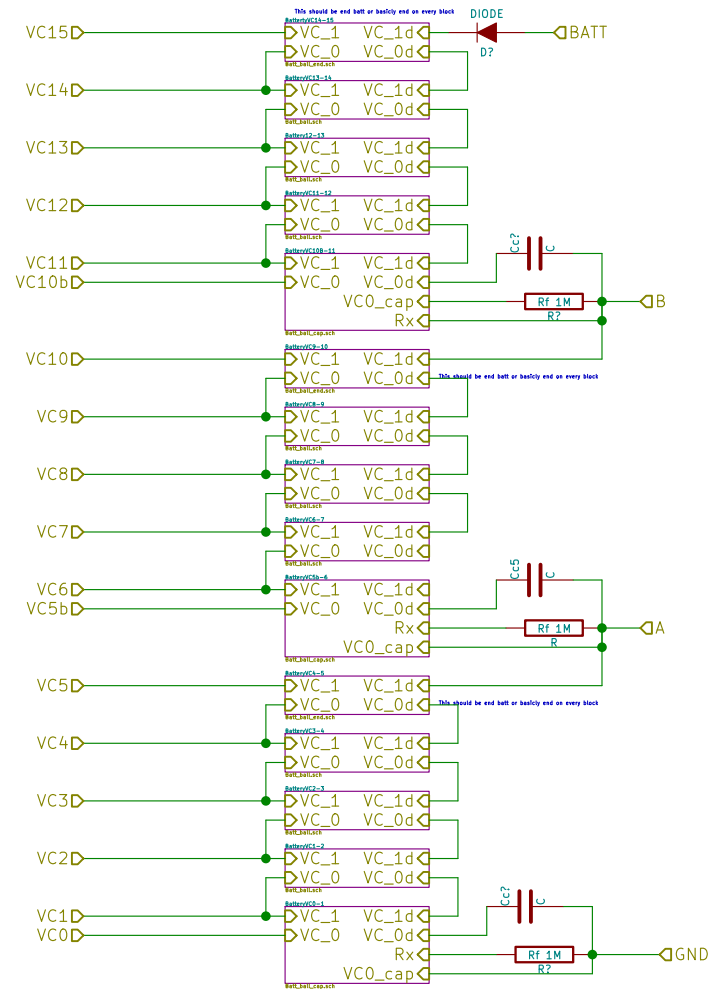
$$V_{TSX} = (ADC \text{ in Decimal}) \times 382 \mu V/LSB$$
$$R_{TS} = (10,000 \times V_{TSX}) \div (3.3 - V_{TSX})$$

Termistors
Connect with outer 6 pin



FESB		
Sheet: /BQ7***/NTC Temp monitor/ File: Temp.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 4/68

Mess bellow. Batt_ball circuit are sharing every pin except last and first
So because they are sharing pin they are sharing a Rin so only
last should have it.(IN every block).



FESB

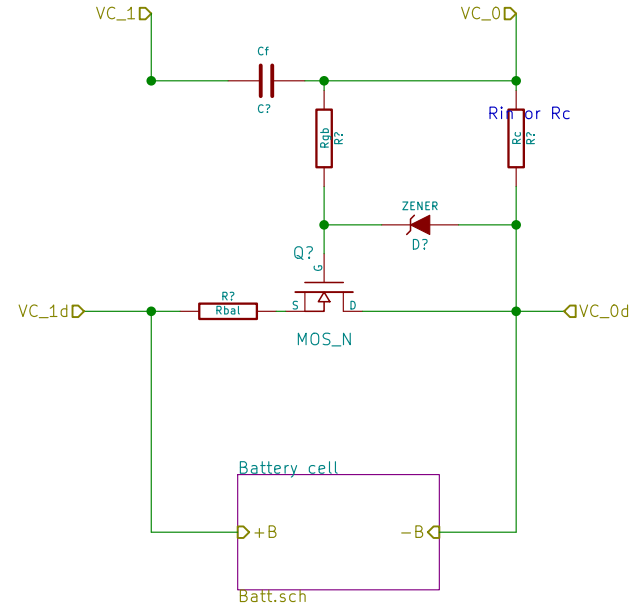
Sheet: /BQ7***/Battery_pack/
File: Batt_pack.sch

Title: Battery Pack

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 5/68

This is just mesurment and balancing circuit



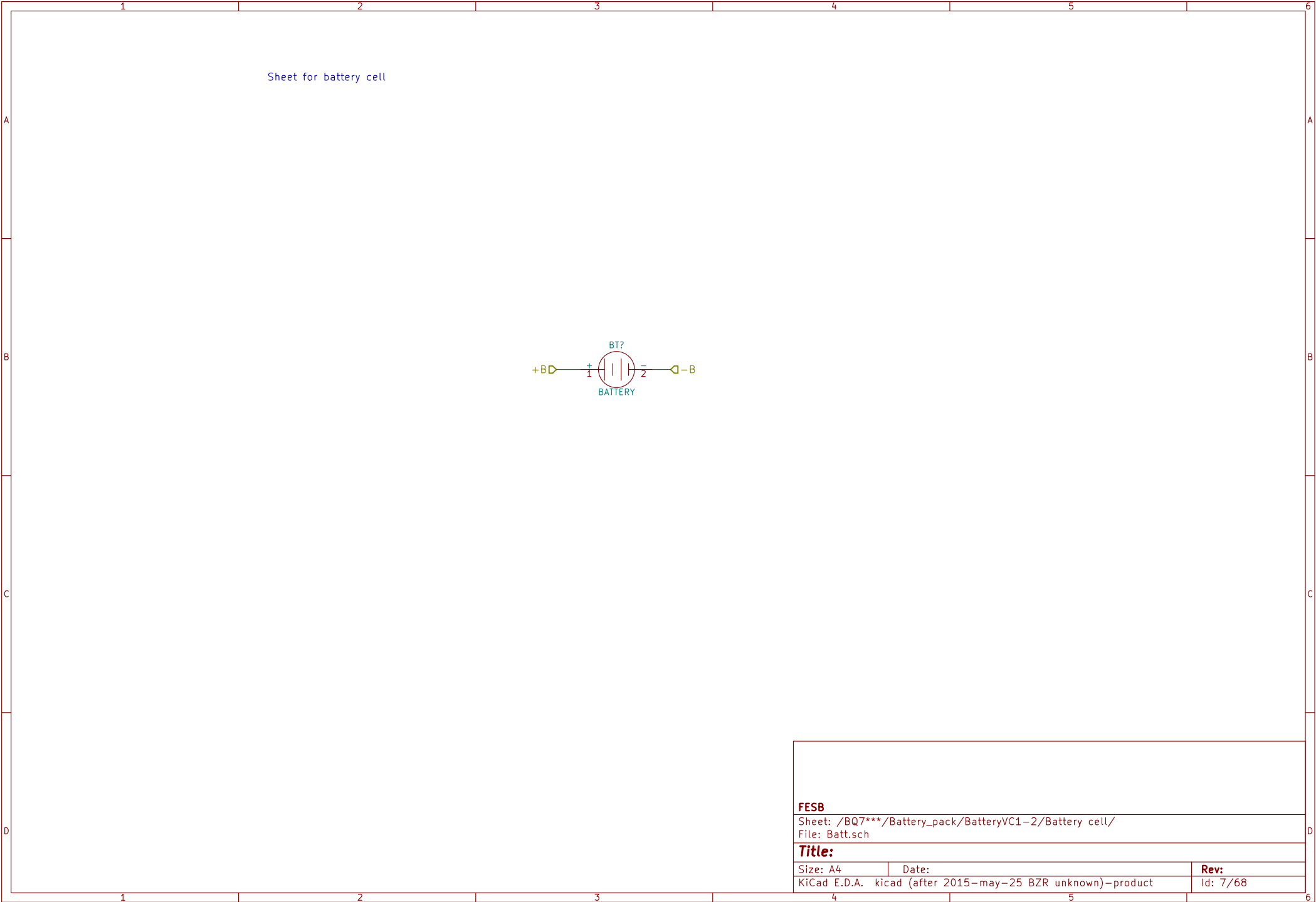
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC1-2/
File: Batt_ball.sch

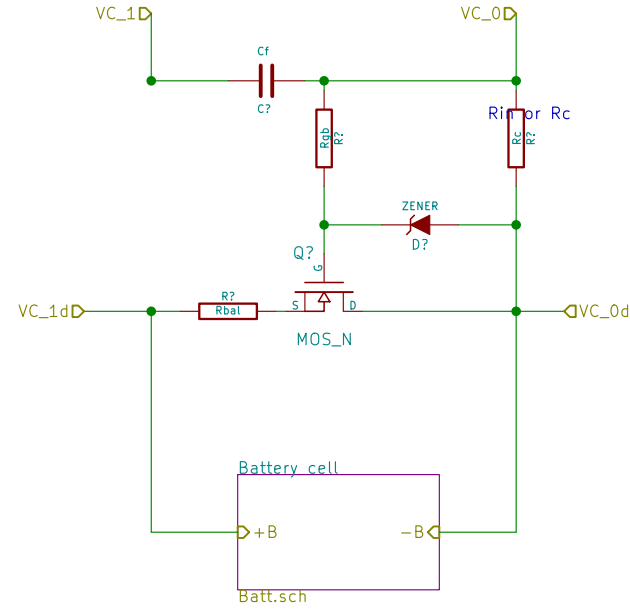
Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 6/68



This is just mesurment and balancing circuit



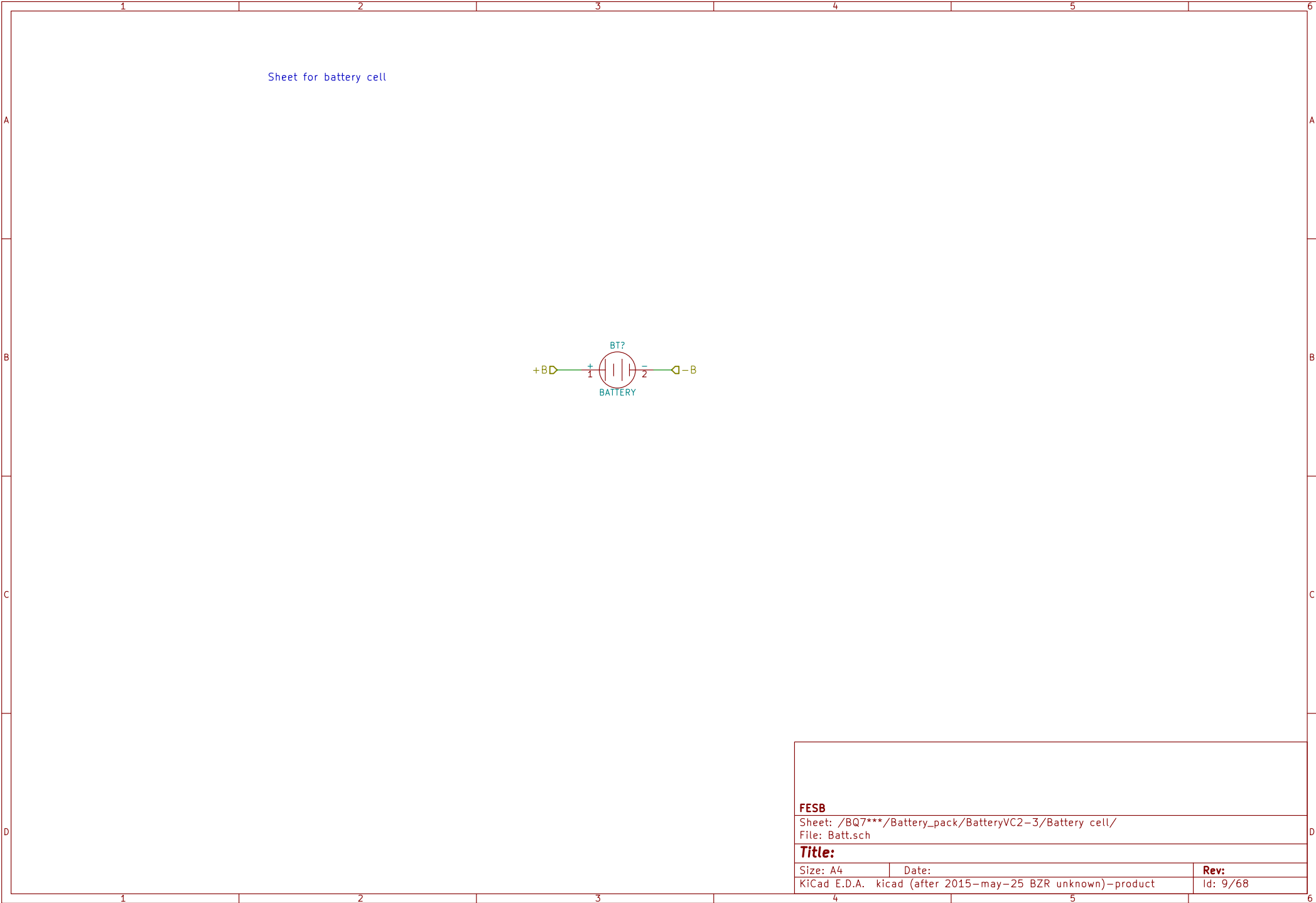
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC2-3/
File: Batt_ball.sch

Title:

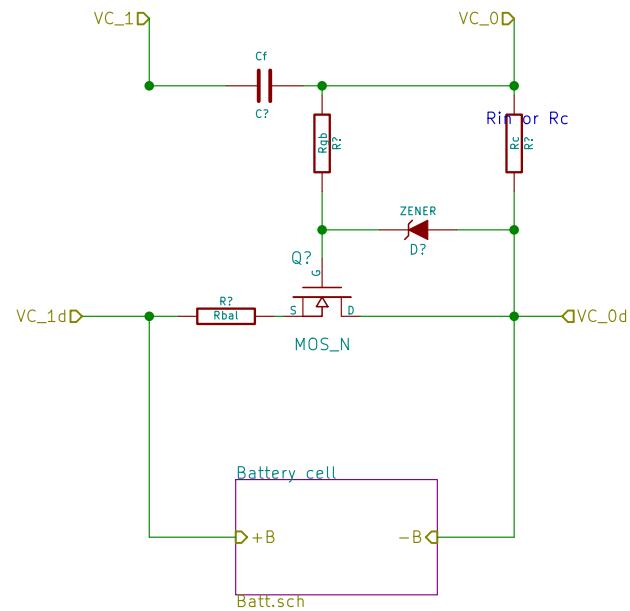
Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev: Id: 8/68



FESB		
Sheet: /BQ7***/Battery_pack/BatteryVC2-3/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 9/68

This is just mesurment and balancing circuit

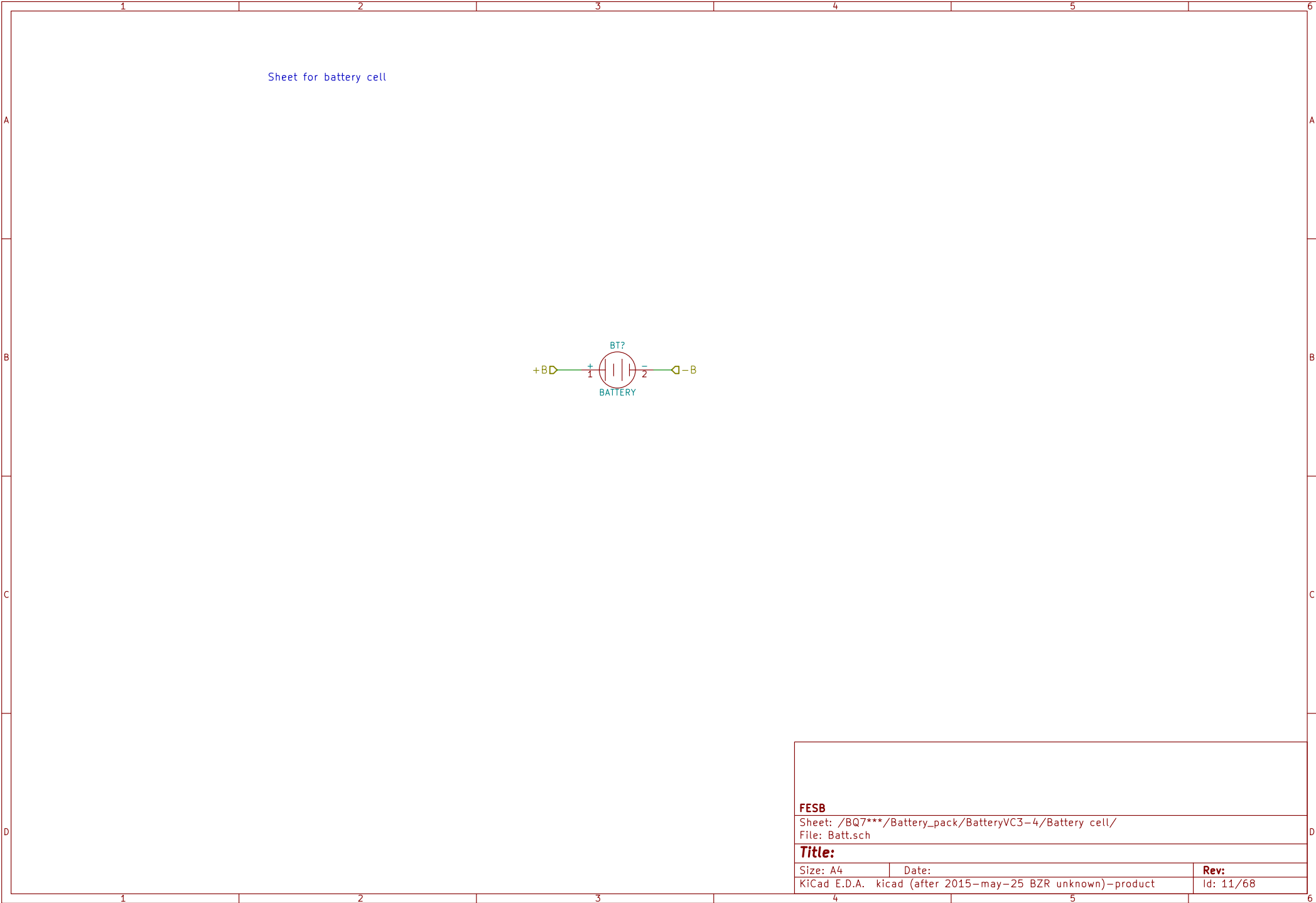


FESB

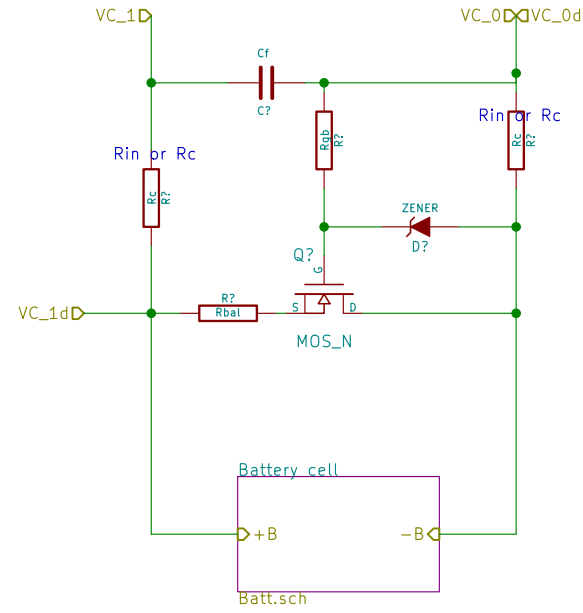
Sheet: /BQ7***/Battery_pack/BatteryVC3-4/
File: Batt_ball.sch

Title:

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 10/68



This is just mesurment and balancing circuit



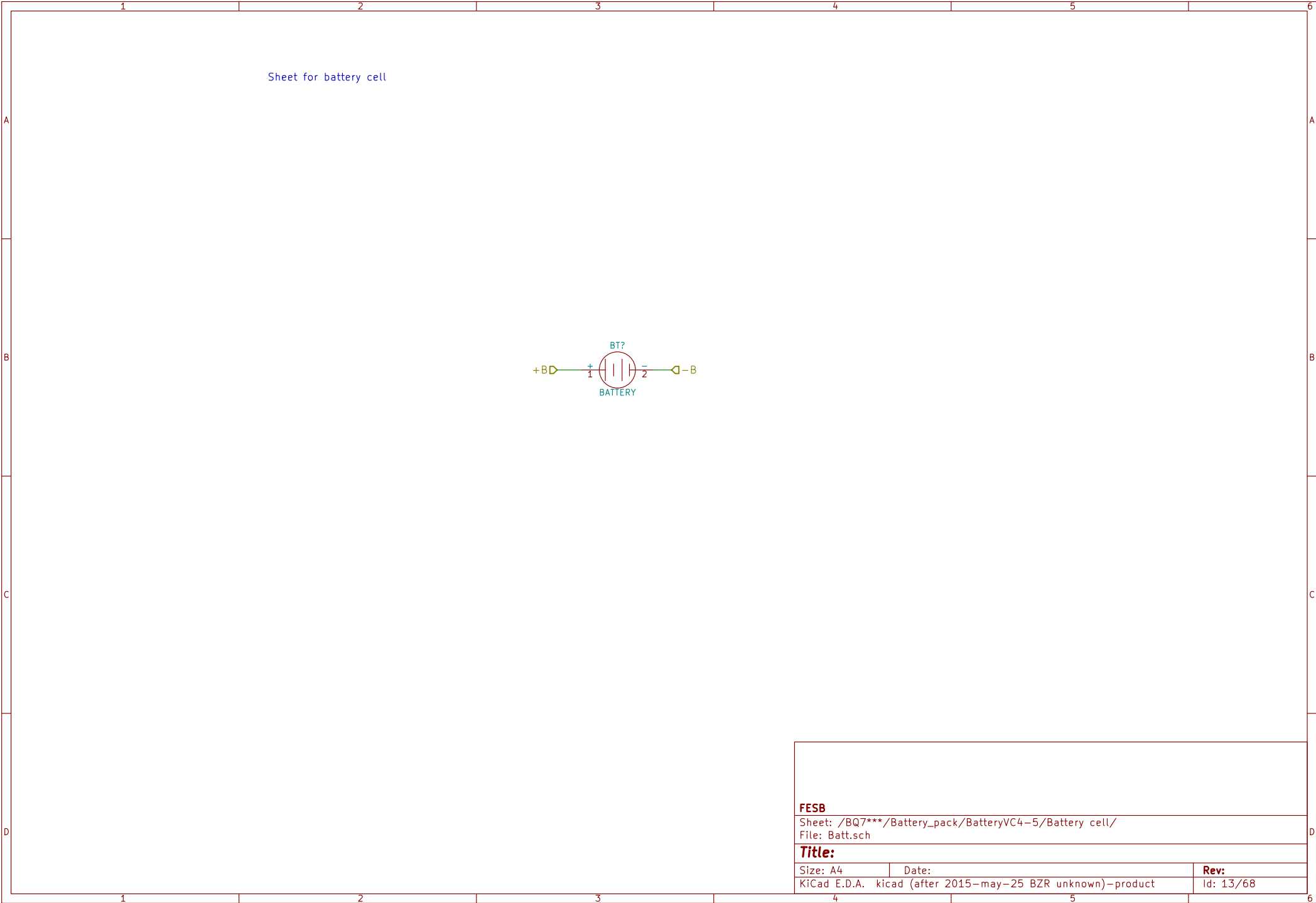
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC4-5/
File: Batt_bal_end.sch

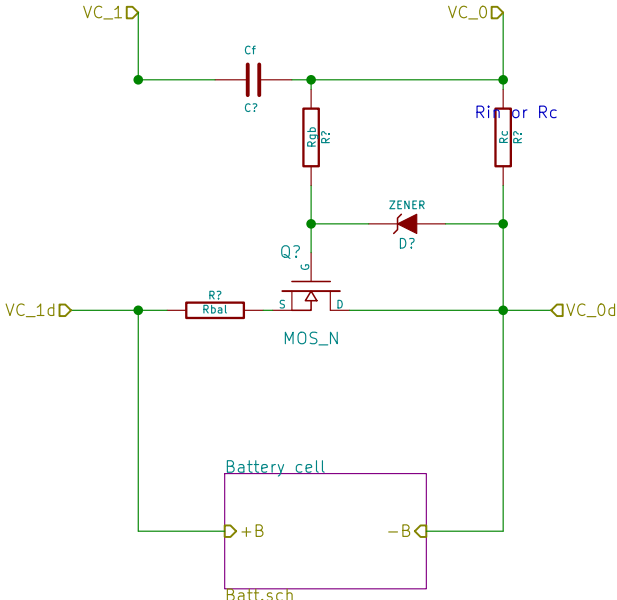
Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 12/68



This is just measurement and balancing circuit



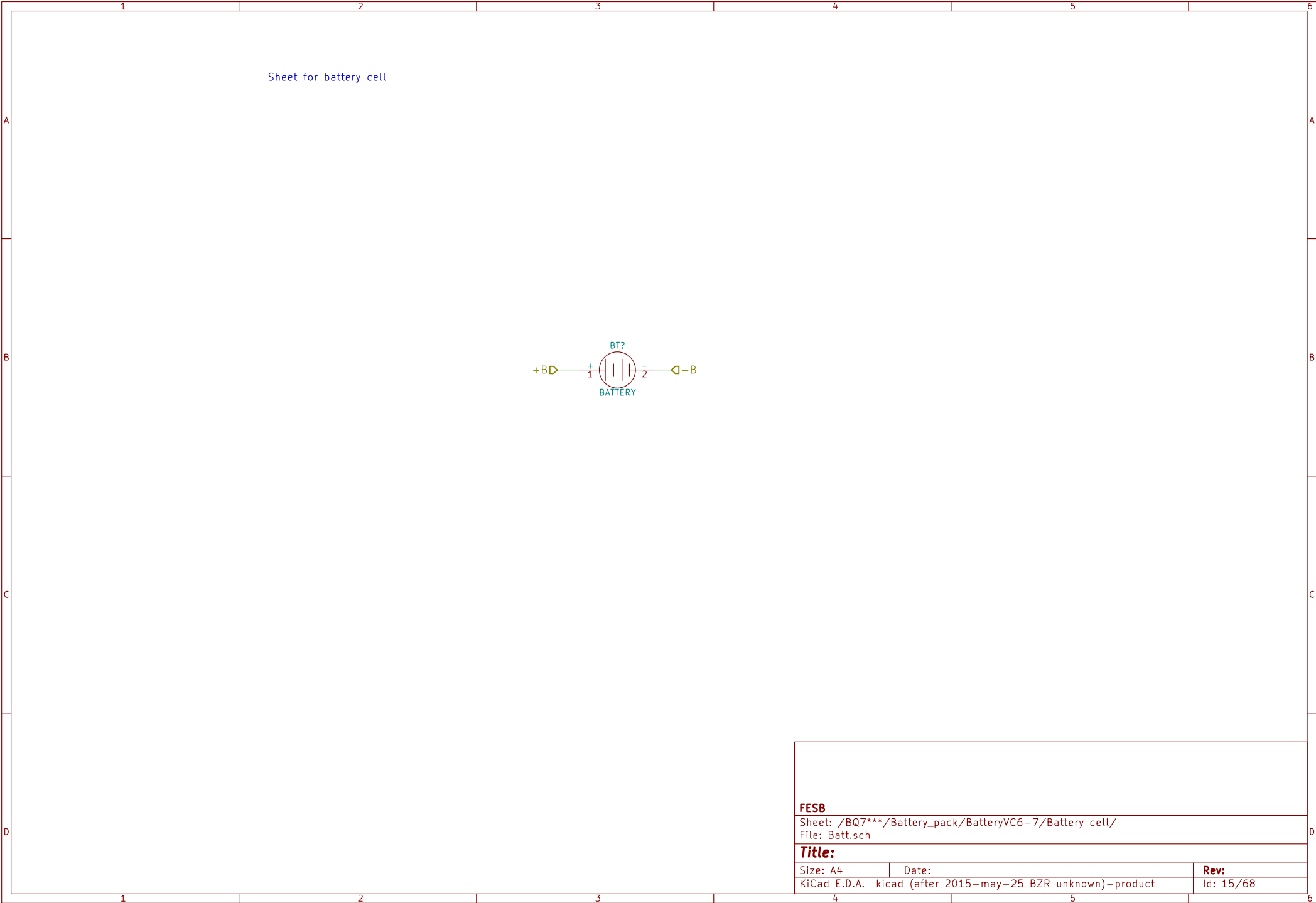
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC6-7/
File: Batt_ball.sch

Title:

Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

Rev: 14/68



FESB

Sheet: /BQ7***/Battery_pack/BatteryVC6-7/Battery cell/
File: Batt.sch

Title:

Size: A4

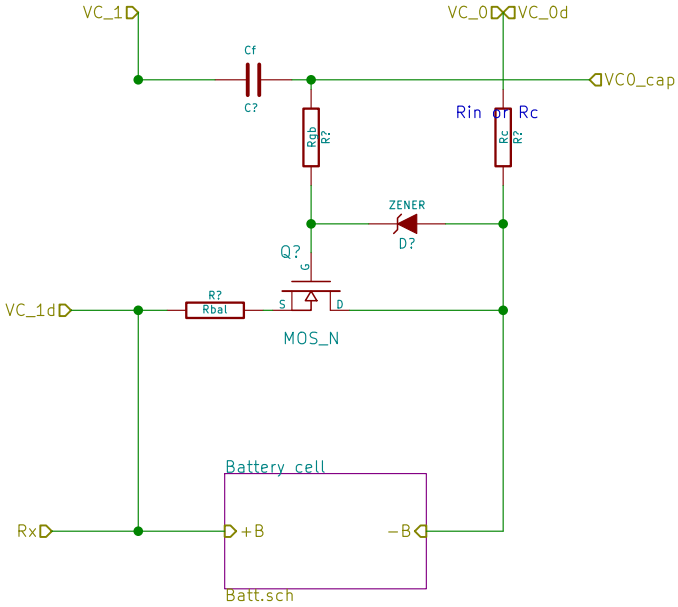
Date:

Rev:

KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Id: 15/68

This is just measurement and balancing circuit



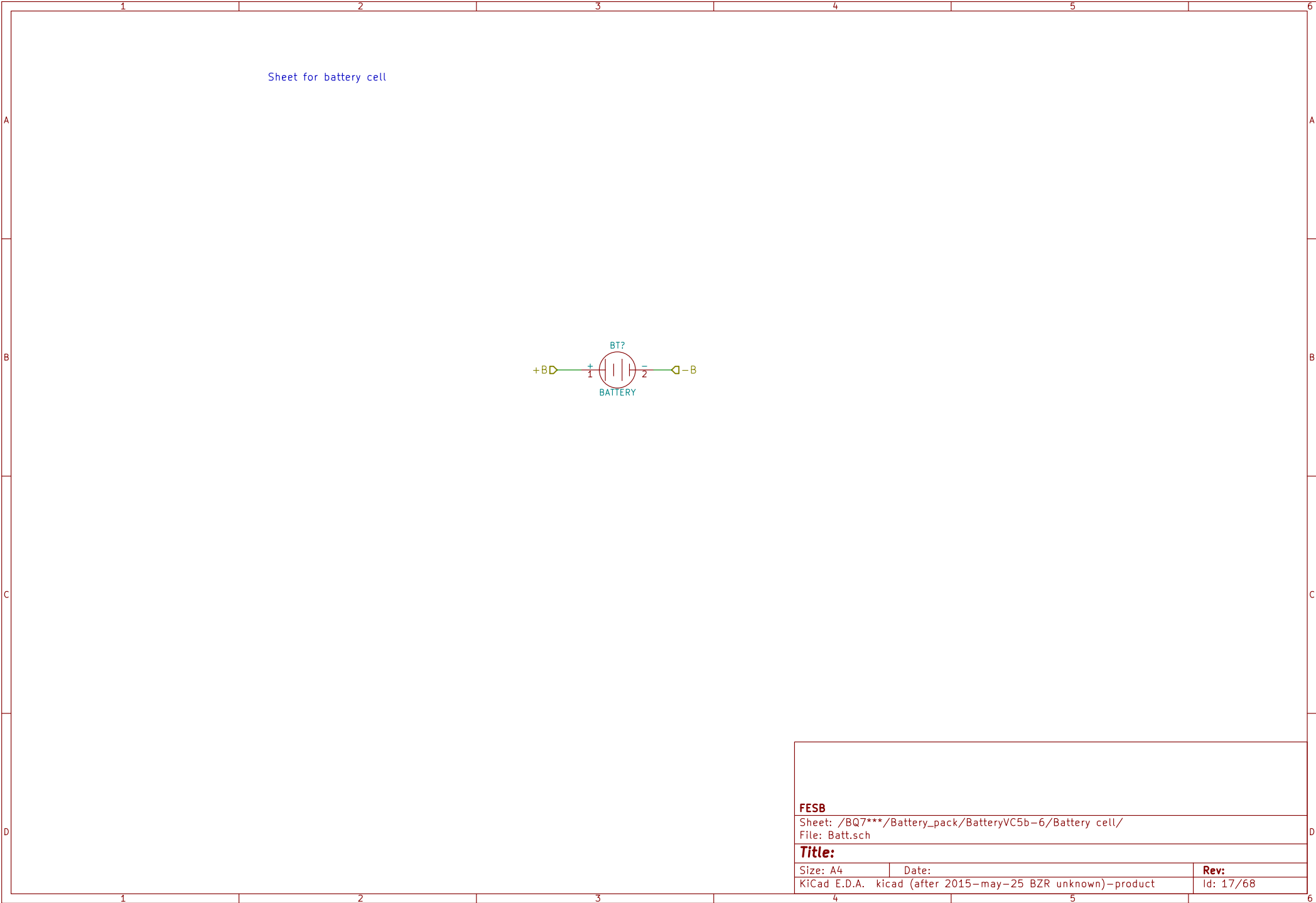
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC5b-6/
File: Batt_ball_cap.sch

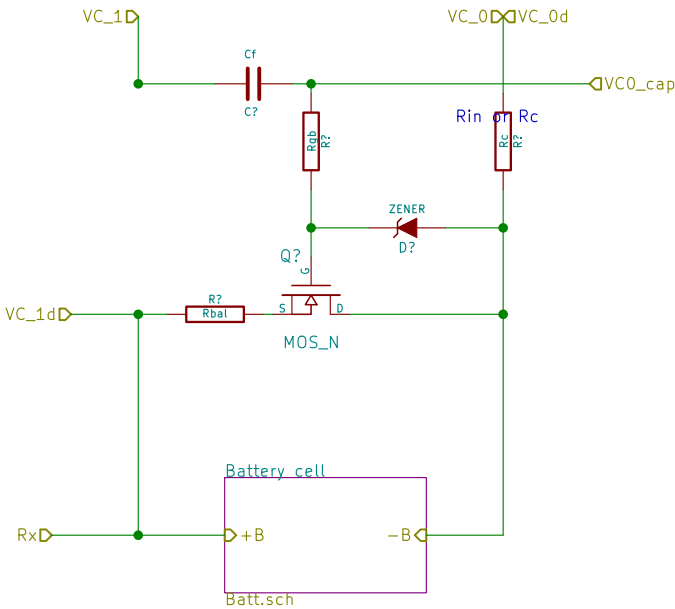
Title:

Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

Rev: 16/68



This is just mesurment and balancing circuit



FESB

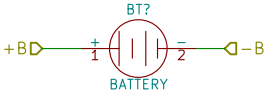
Sheet: /BQ7***/Battery_pack/BatteryVC0-1/
File: Batt_ball_cap.sch

Title:

Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

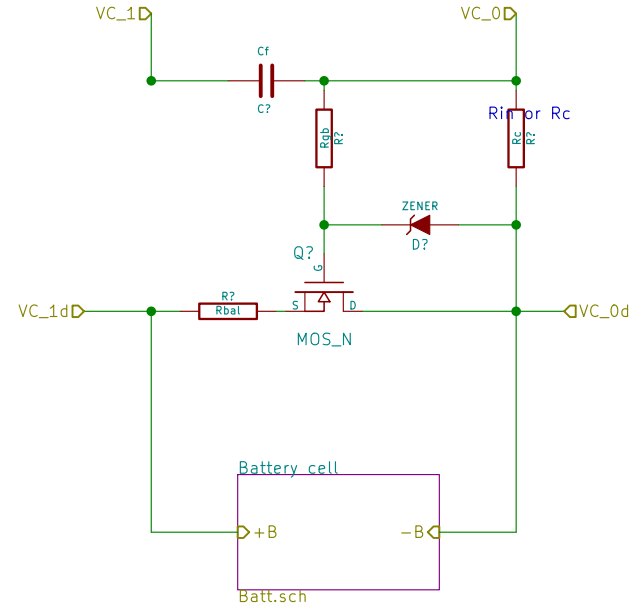
Rev: Id: 18/68

Sheet for battery cell



FESB		
Sheet: /BQ7***/Battery_pack/BatteryVC0-1/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 19/68

This is just mesurment and balancing circuit



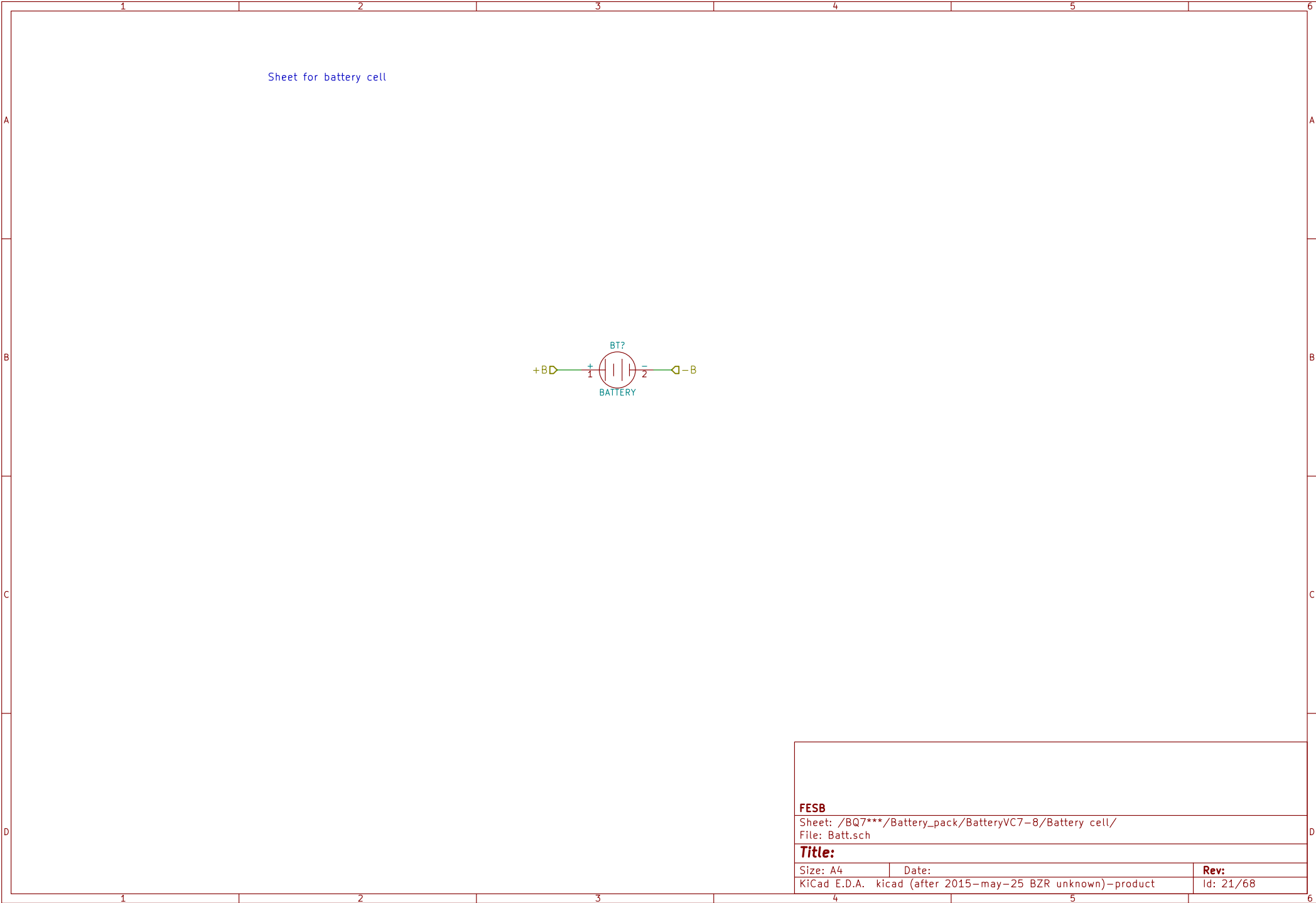
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC7-8/
File: Batt_ball.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 20/68



FESB

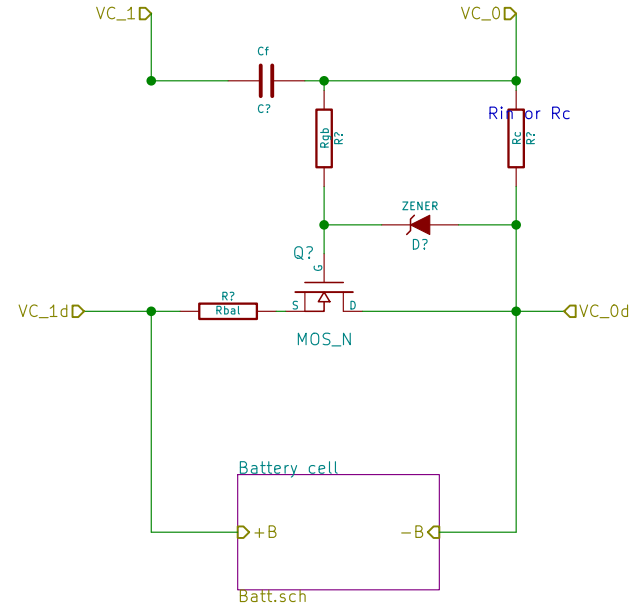
Sheet: /BQ7***/Battery_pack/BatteryVC7-8/Battery cell/
File: Batt.sch

Title:

Size: A4Date:KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:Id: 21/68

This is just mesurment and balancing circuit



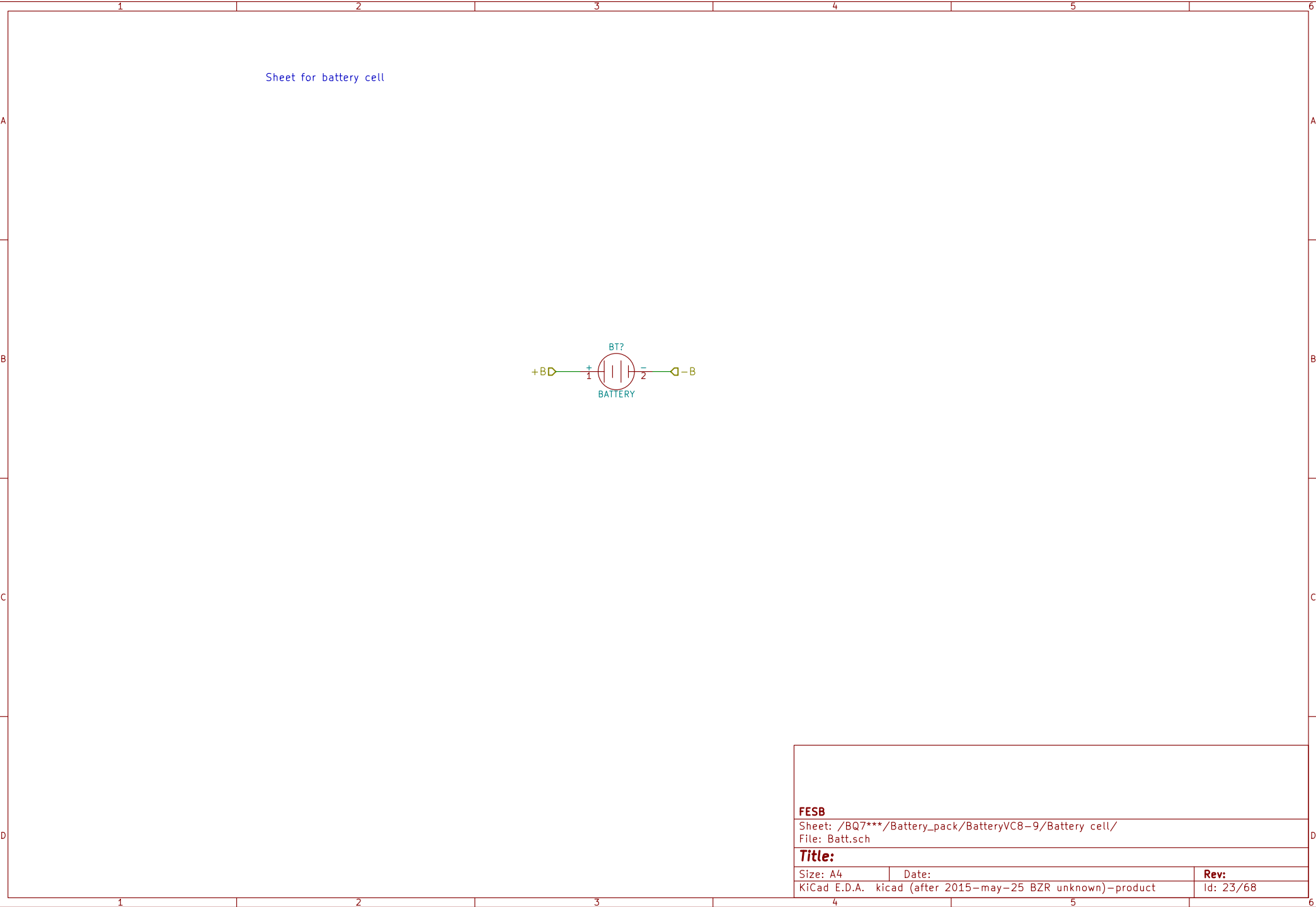
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC8-9/
File: Batt_ball.sch

Title:

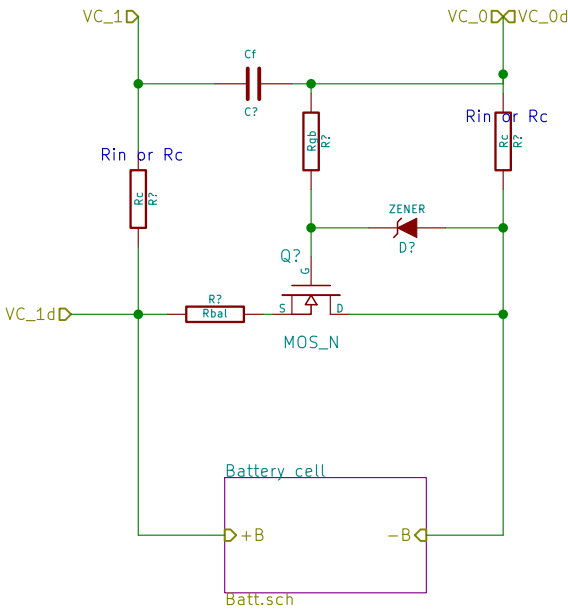
Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 22/68



FESB		
Sheet: /BQ7***/Battery_pack/BatteryVC8-9/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 23/68

This is just mesurment and balancing circuit



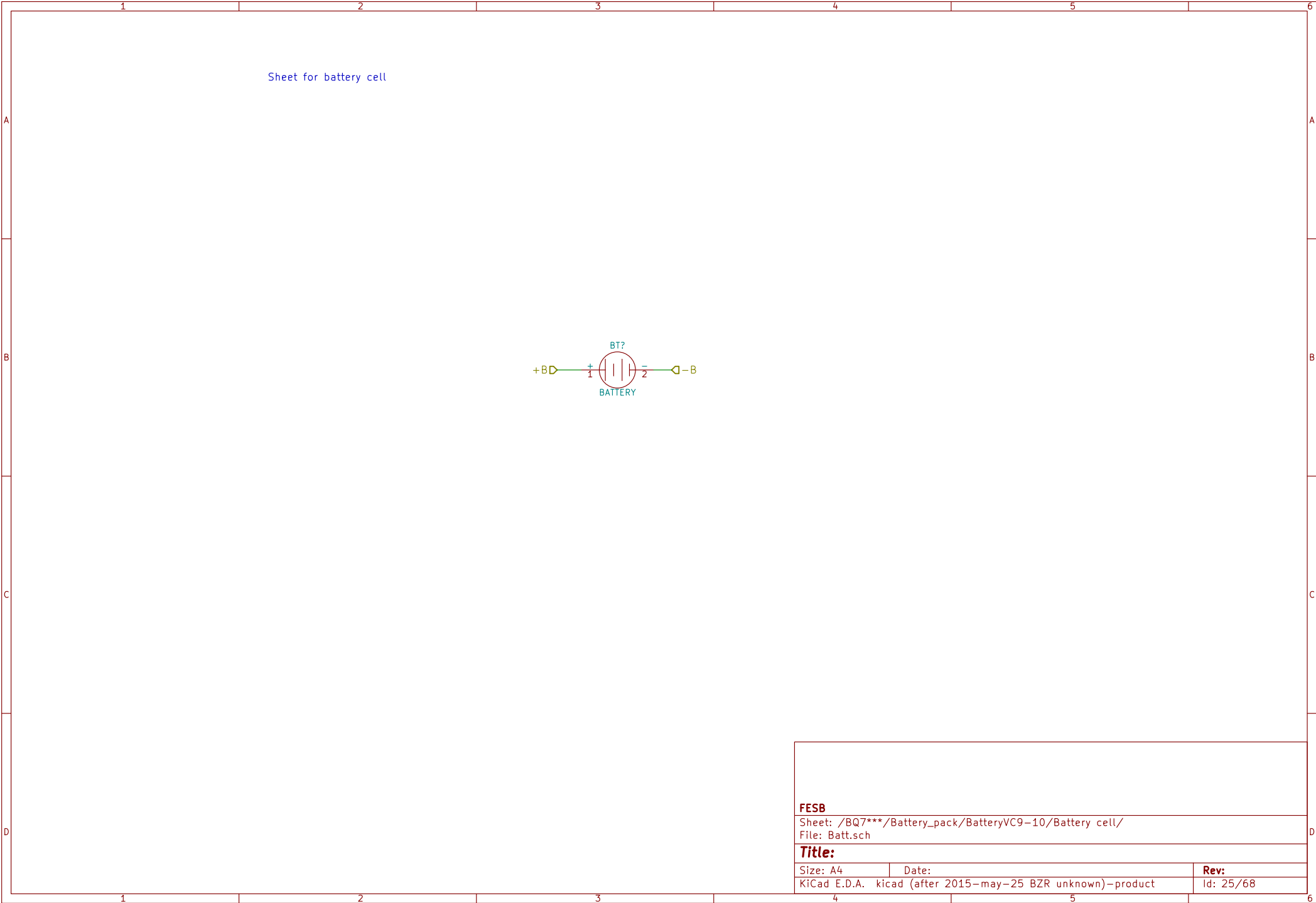
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC9-10/
File: Batt_bal_end.sch

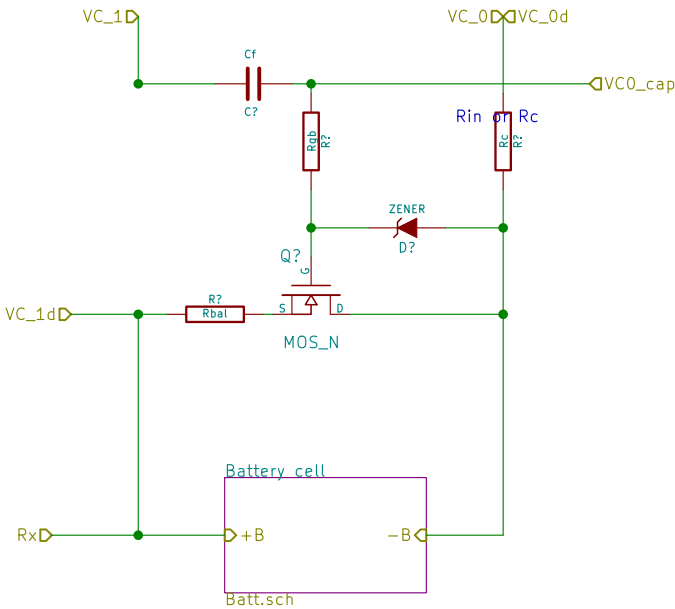
Title:

Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev: Id: 24/68



This is just mesurment and balancing circuit



FESB

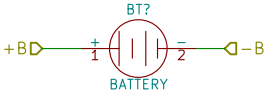
Sheet: /BQ7***/Battery_pack/BatteryVC10B-11/
File: Batt_ball_cap.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

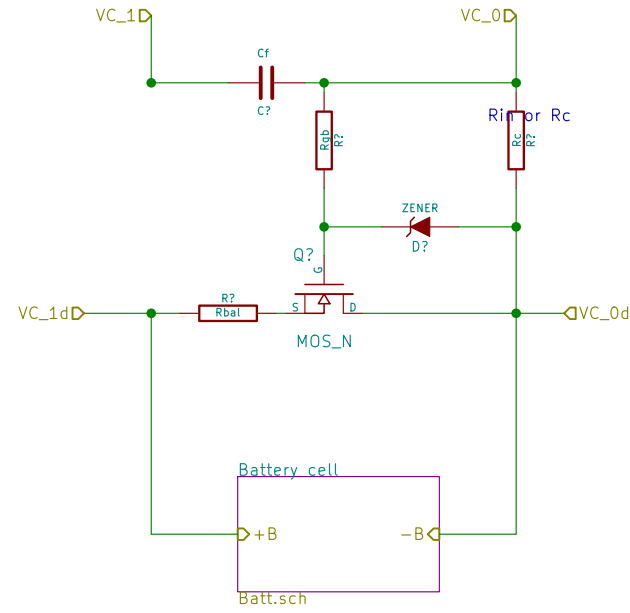
Rev:
Id: 26/68

Sheet for battery cell



FESB		
Sheet: /BQ7***/Battery_pack/BatteryVC10B-11/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 27/68

This is just mesurment and balancing circuit



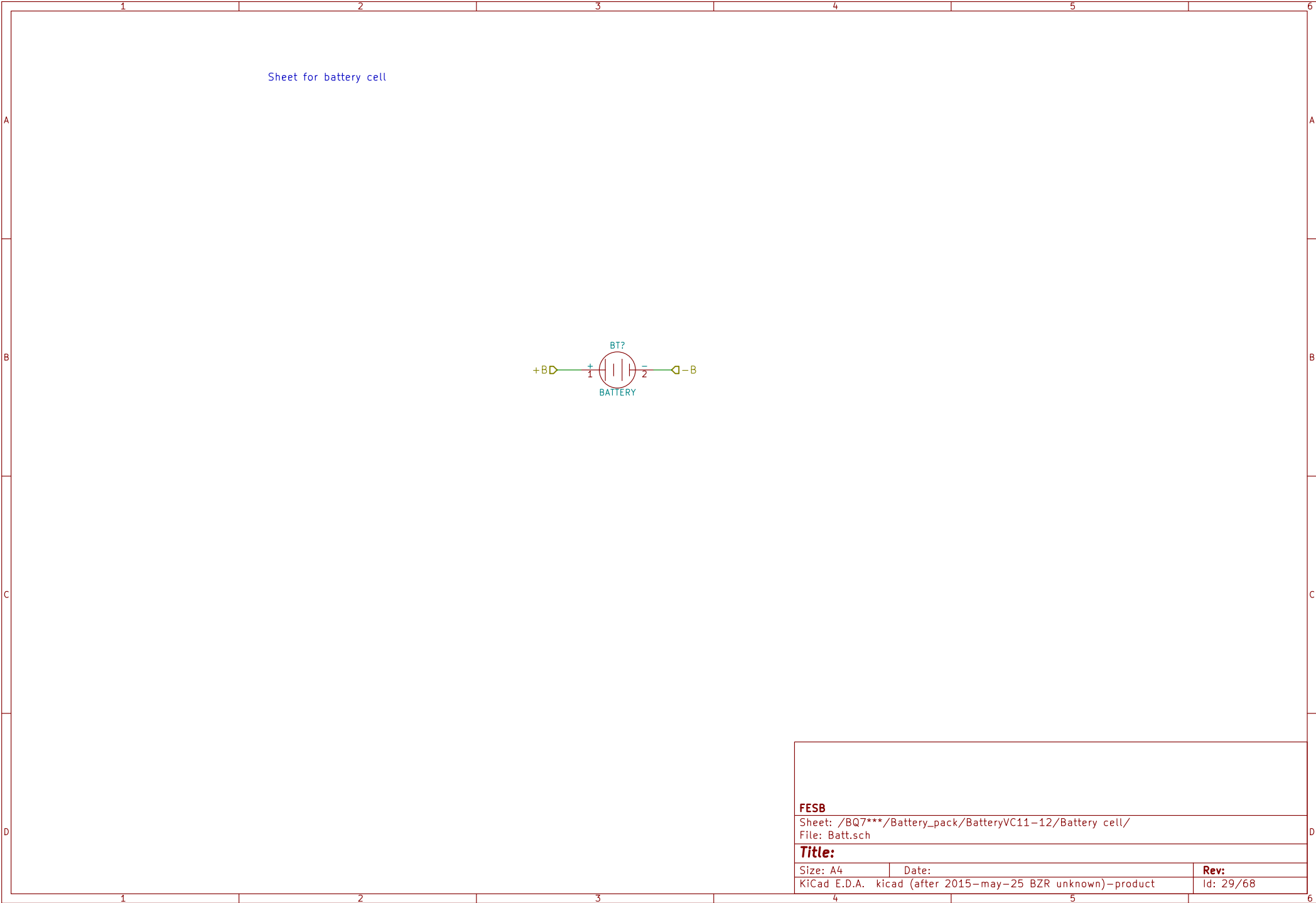
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC11-12/
File: Batt_ball.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 28/68



FESB

Sheet: /BQ7***/Battery_pack/BatteryVC11-12/Battery cell/
File: Batt.sch

Title:

Size: A4

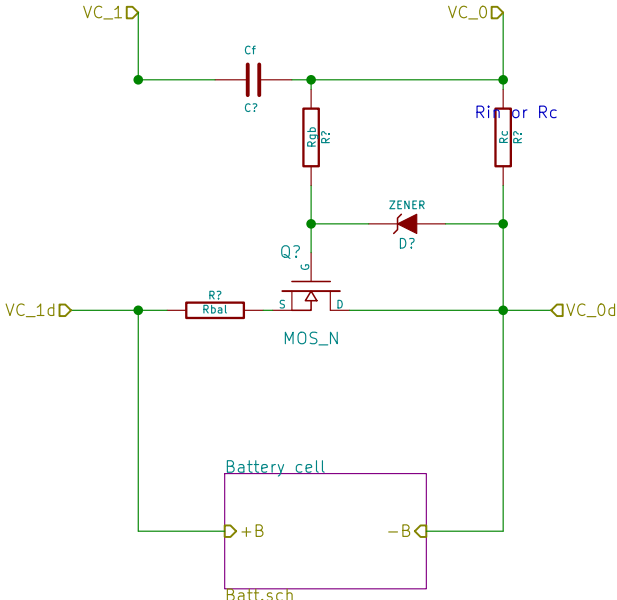
Date:

Rev:

KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Id: 29/68

This is just measurement and balancing circuit



FESB

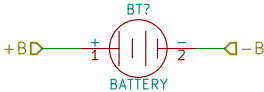
Sheet: /BQ7***/Battery_pack/Battery12-13,
File: Batt_ball.sch

Title:

Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

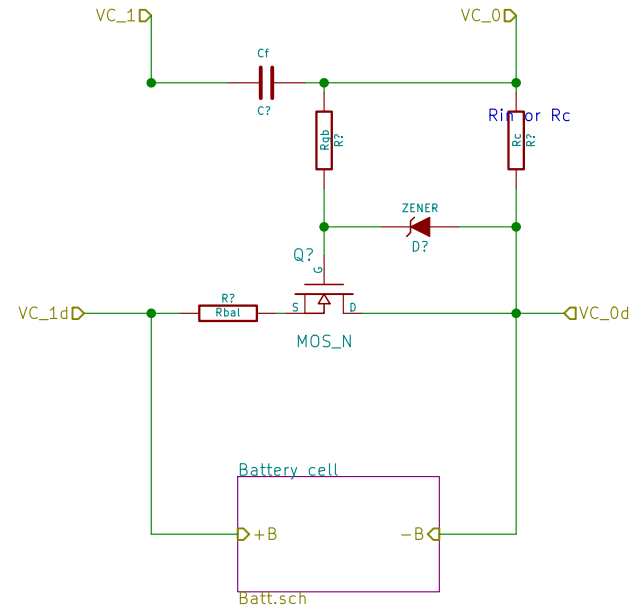
Rev:
Id: 30/68

Sheet for battery cell



FESB		
Sheet: /BQ7***/Battery_pack/Battery12-13/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 31/68

This is just mesurment and balancing circuit



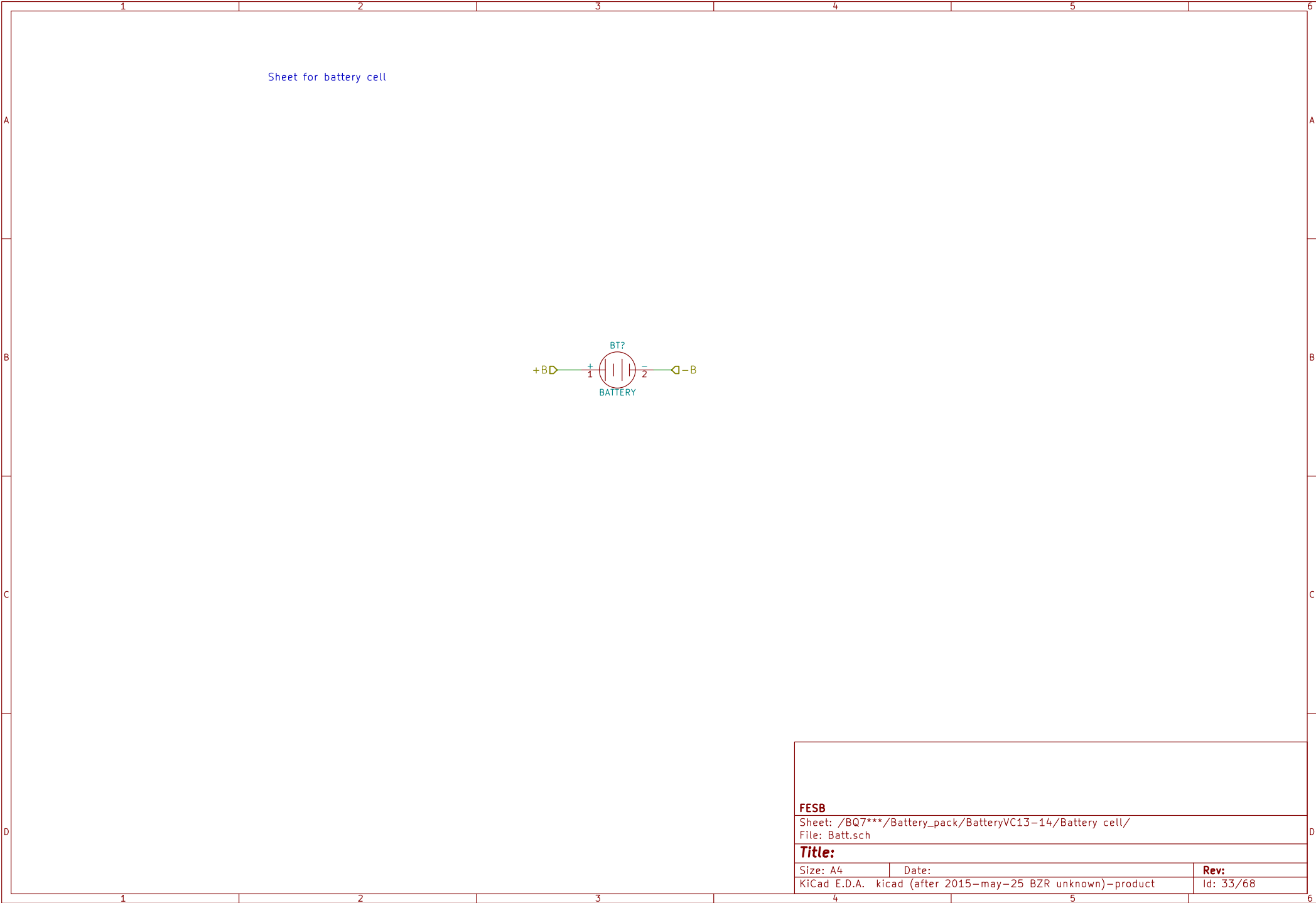
FESB

Sheet: /BQ7***/Battery_pack/BatteryVC13-14/
File: Batt_ball.sch

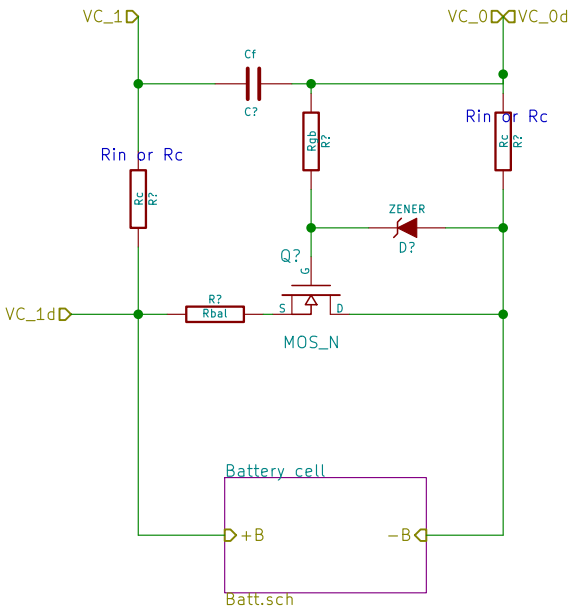
Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 32/68



This is just mesurment and balancing circuit



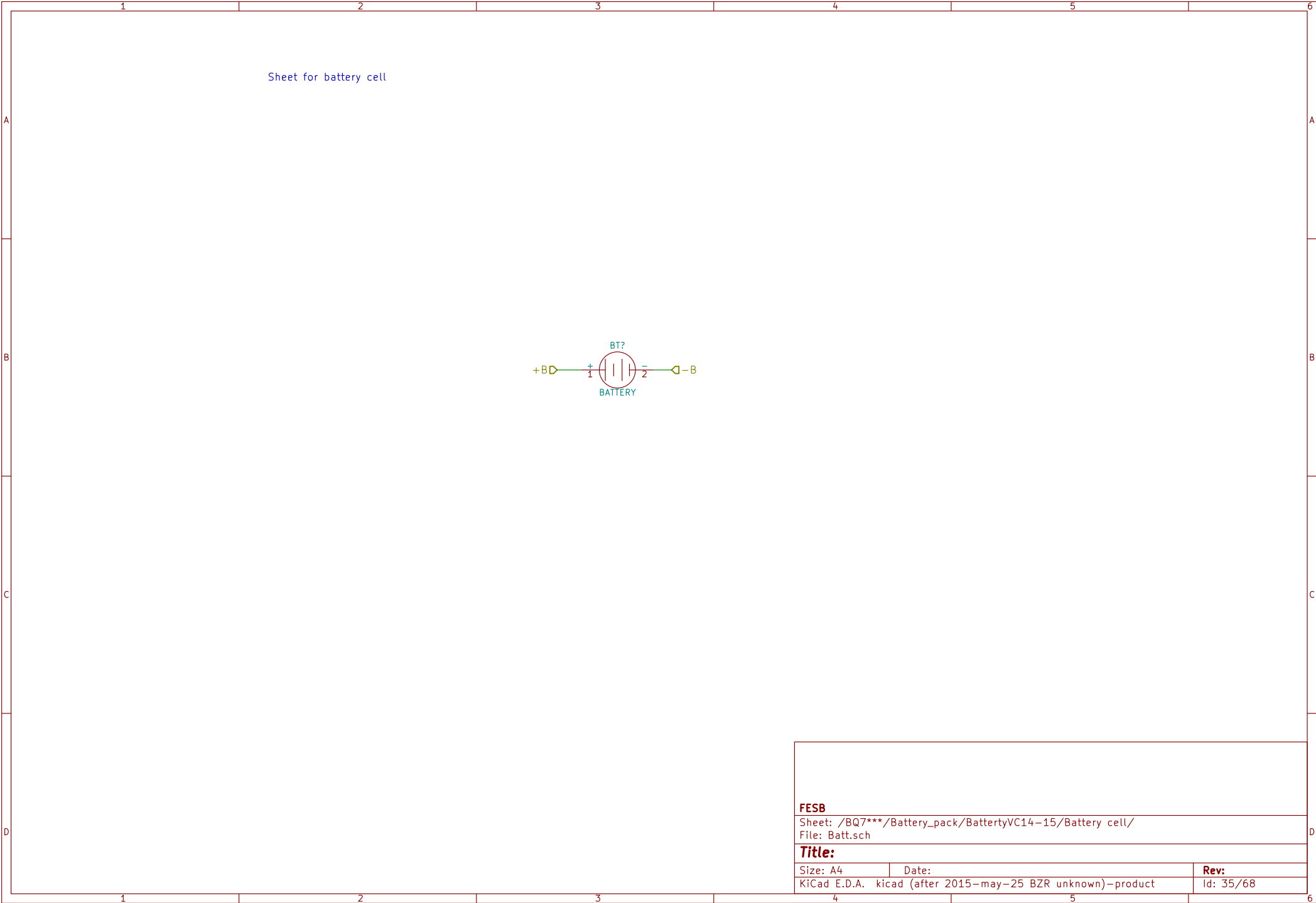
FESB

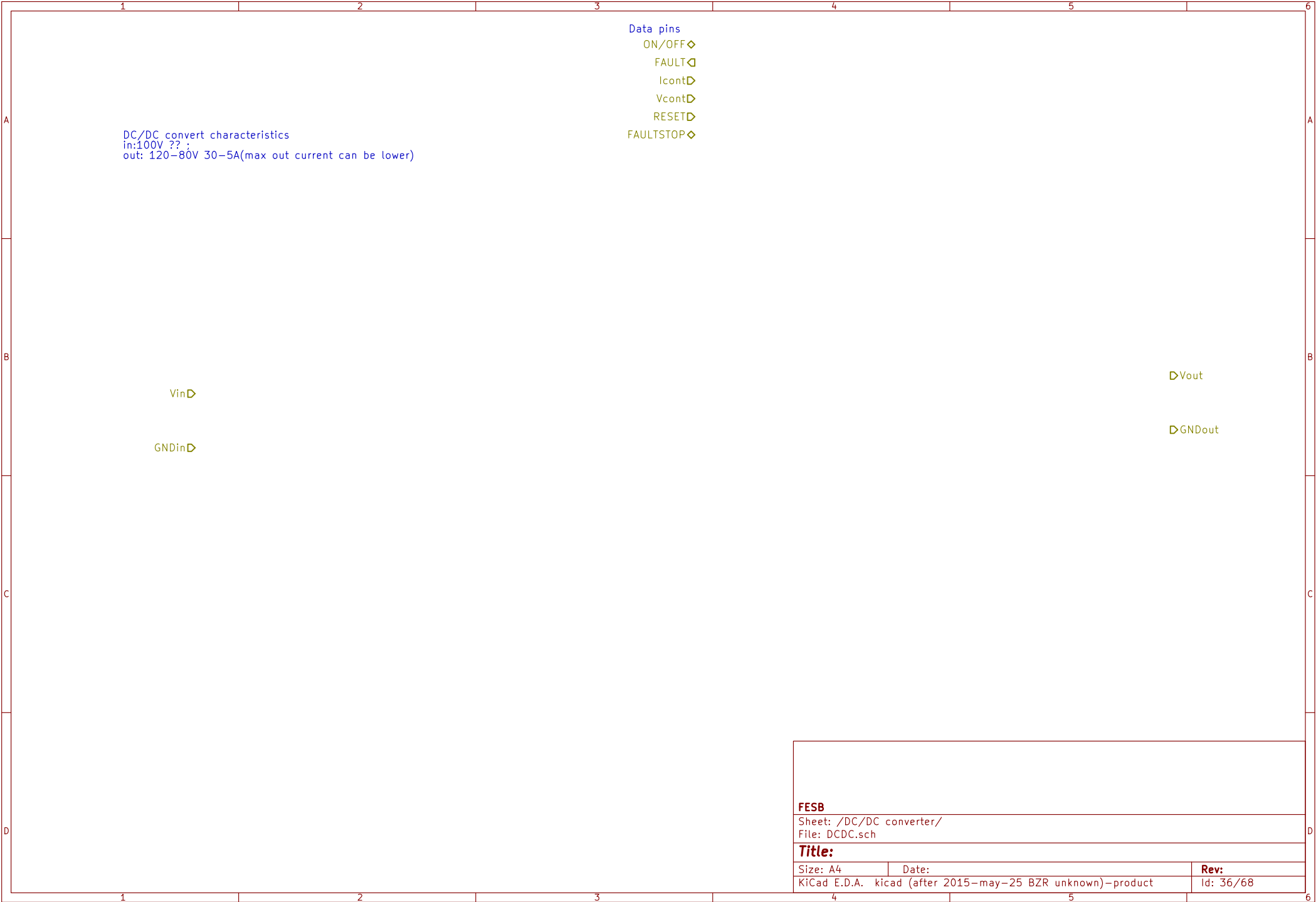
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File: Batt_bal_end.sch

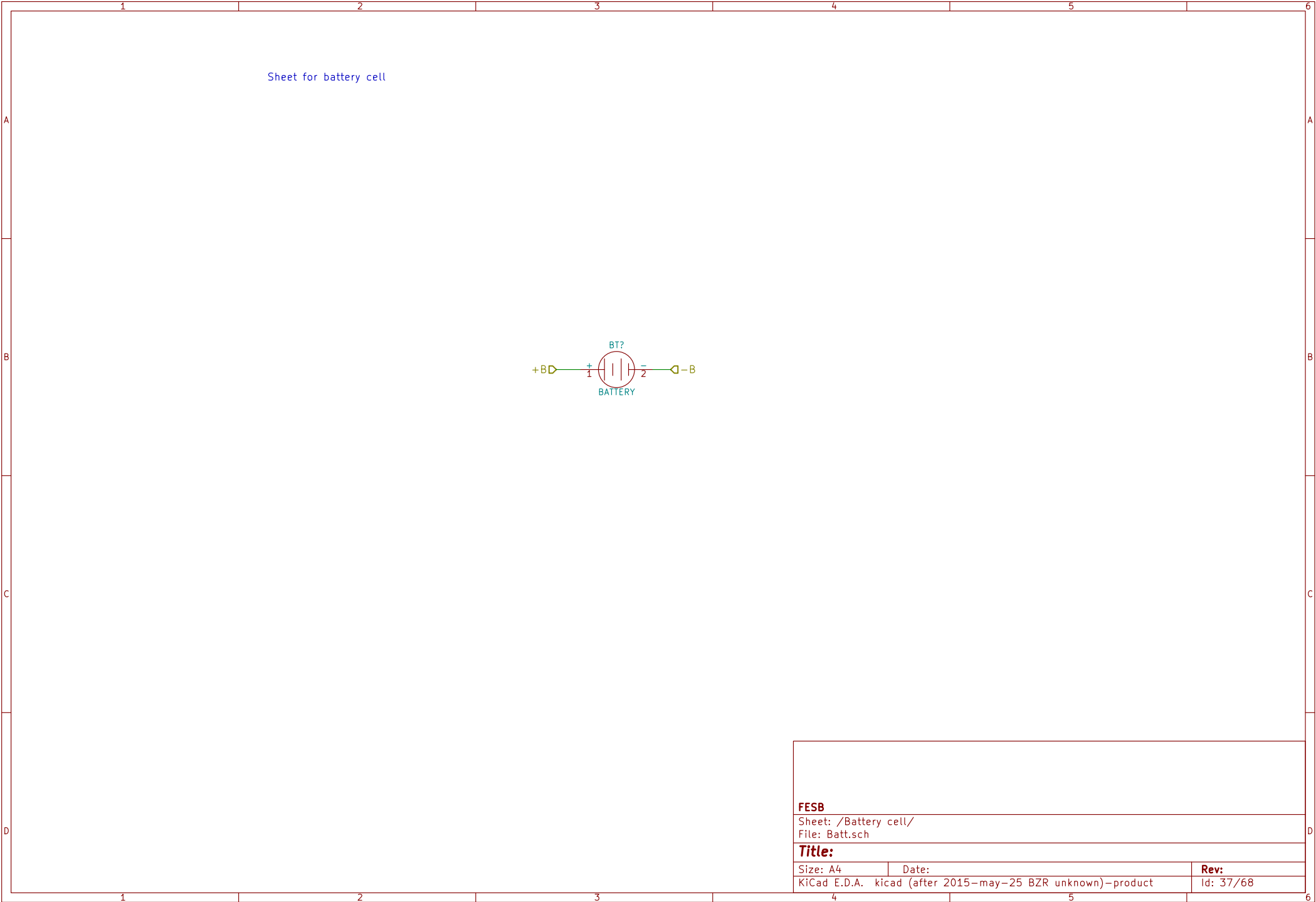
Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

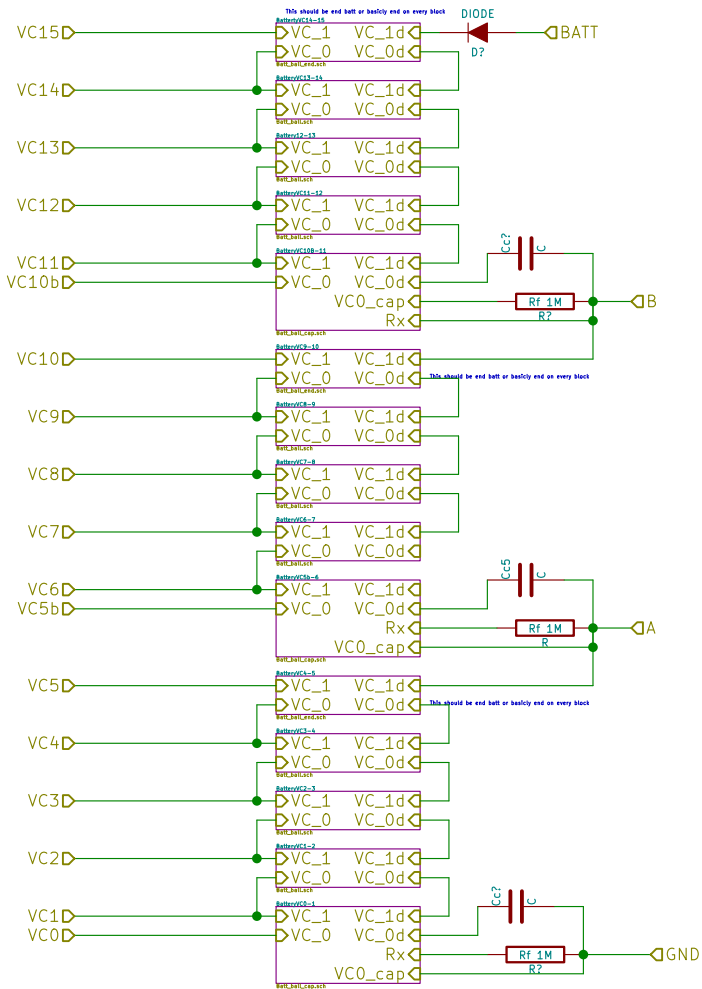
Rev:
Id: 34/68







Mess bellow. Batt_ball circuit are sharing every pin except last and first
So because they are sharing pin they are sharing a Rin so only
last should have it.(IN every block).



FESB

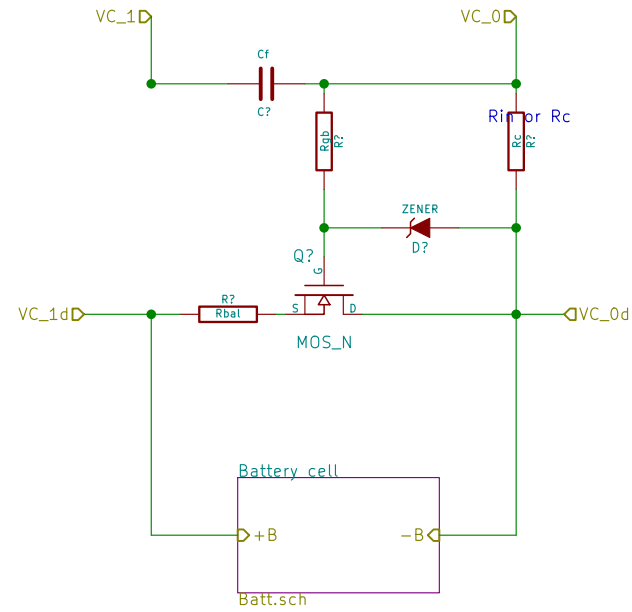
Sheet: /Battery_pack/
File: Batt_pack.sch

Title: Battery Pack

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 38/68

This is just mesurment and balancing circuit



FESB

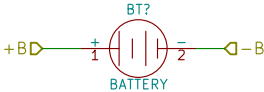
Sheet: /Battery_pack/BatteryVC1-2/
File: Batt_ball.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

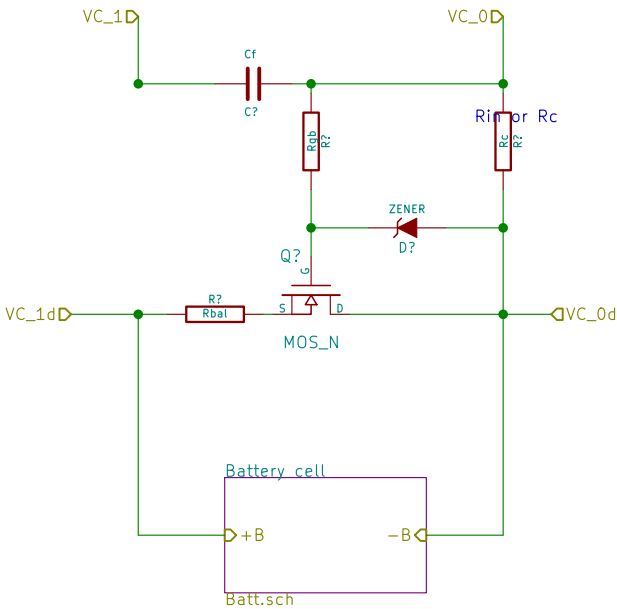
Rev:
Id: 39/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC1-2/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 40/68

This is just mesurment and balancing circuit



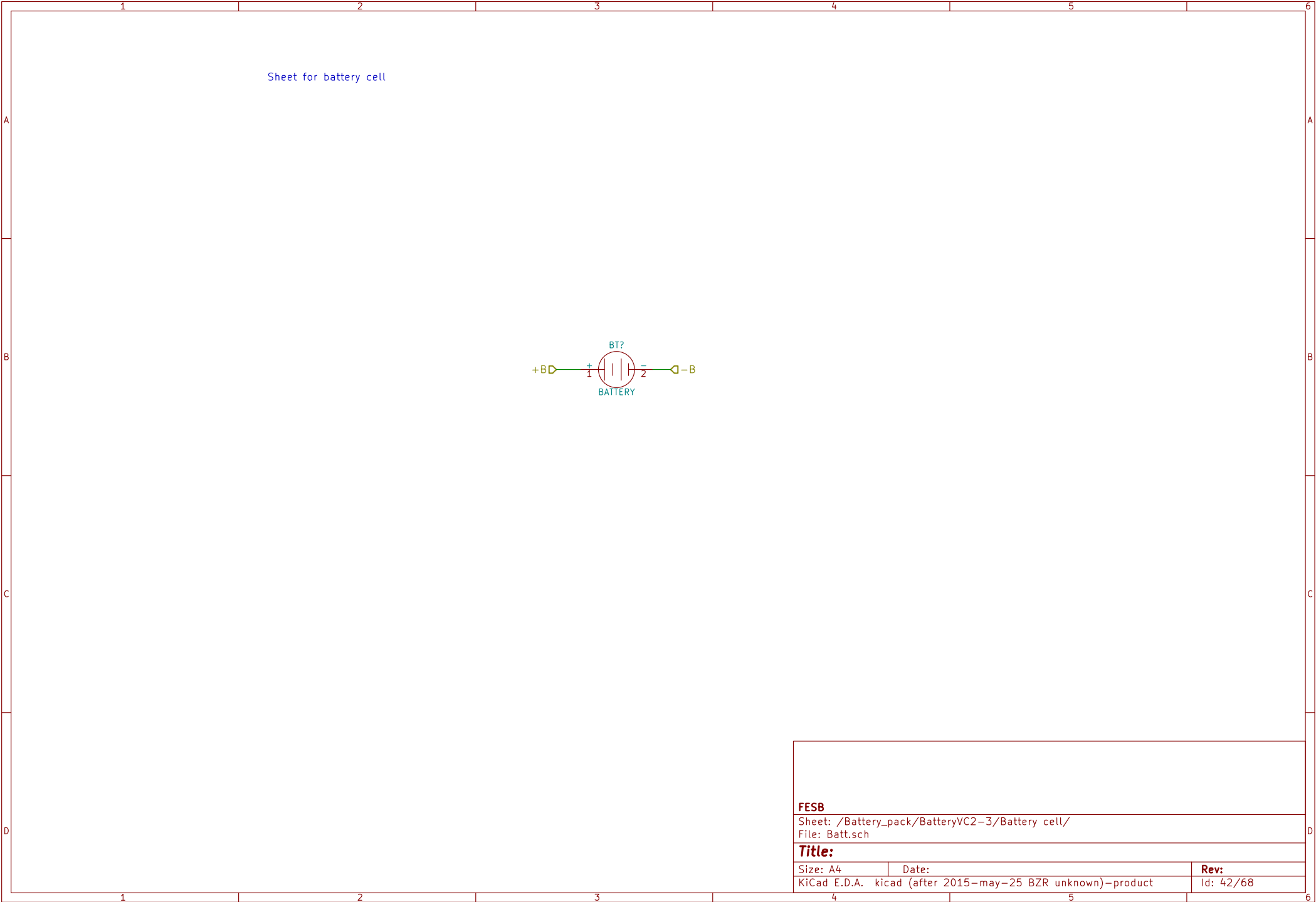
FESB

Sheet: /Battery_pack/BatteryVC2-3/
File: Batt_ball.sch

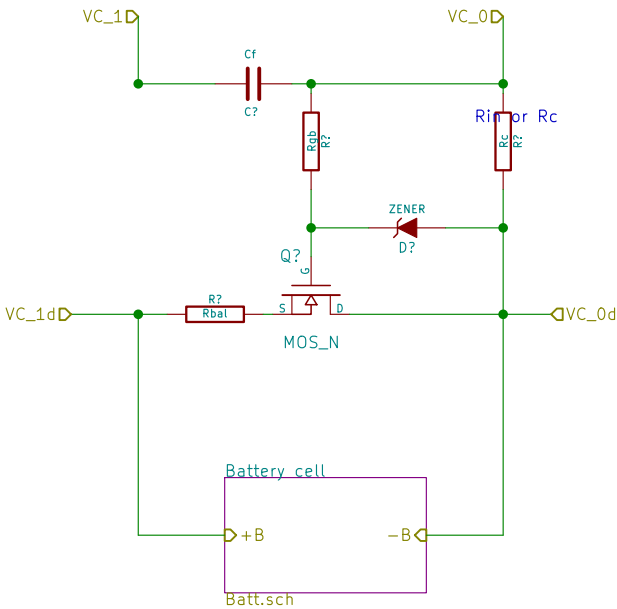
Title:

Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev: Id: 41/68



This is just mesurment and balancing circuit



FESB

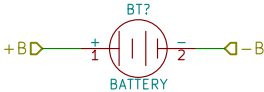
Sheet: /Battery_pack/BatteryVC3-4/
File: Batt_ball.sch

Title:

Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

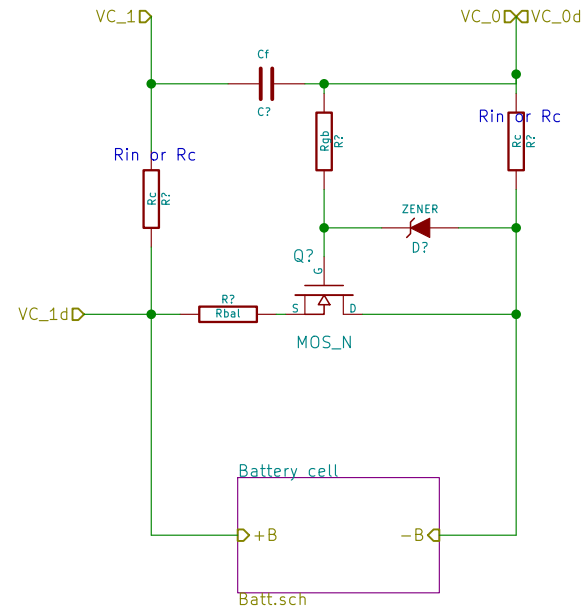
Rev: Id: 43/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC3-4/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 44/68

This is just mesurment and balancing circuit



FESB

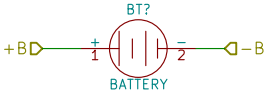
Sheet: /Battery_pack/BatteryVC4-5/
File: Batt_ball_end.sch

Title:

Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

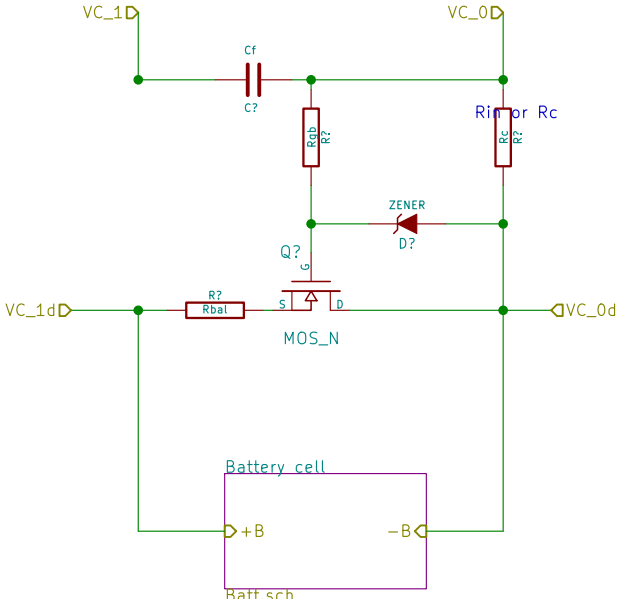
Rev: Id: 45/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC4-5/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 46/68

This is just measurement and balancing circuit



FESB

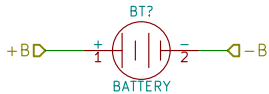
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File: Batt_ball.sch

Title:

Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

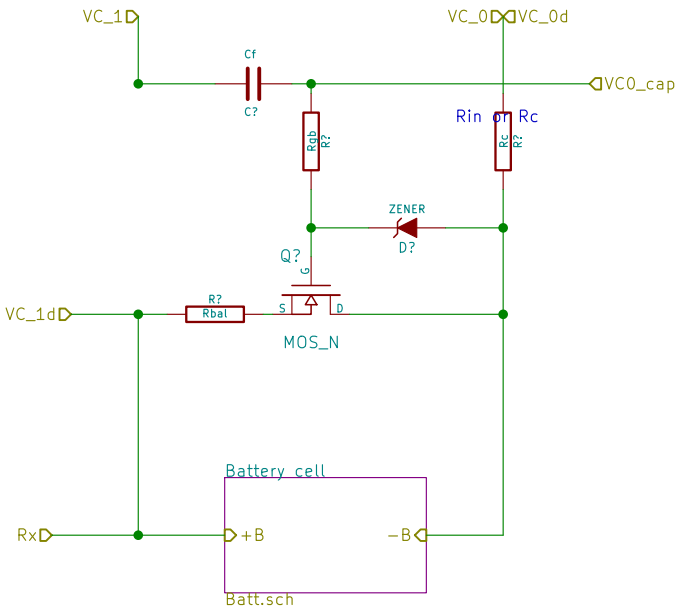
Rev:
Id: 47/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC6-7/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 48/68

This is just mesurment and balancing circuit



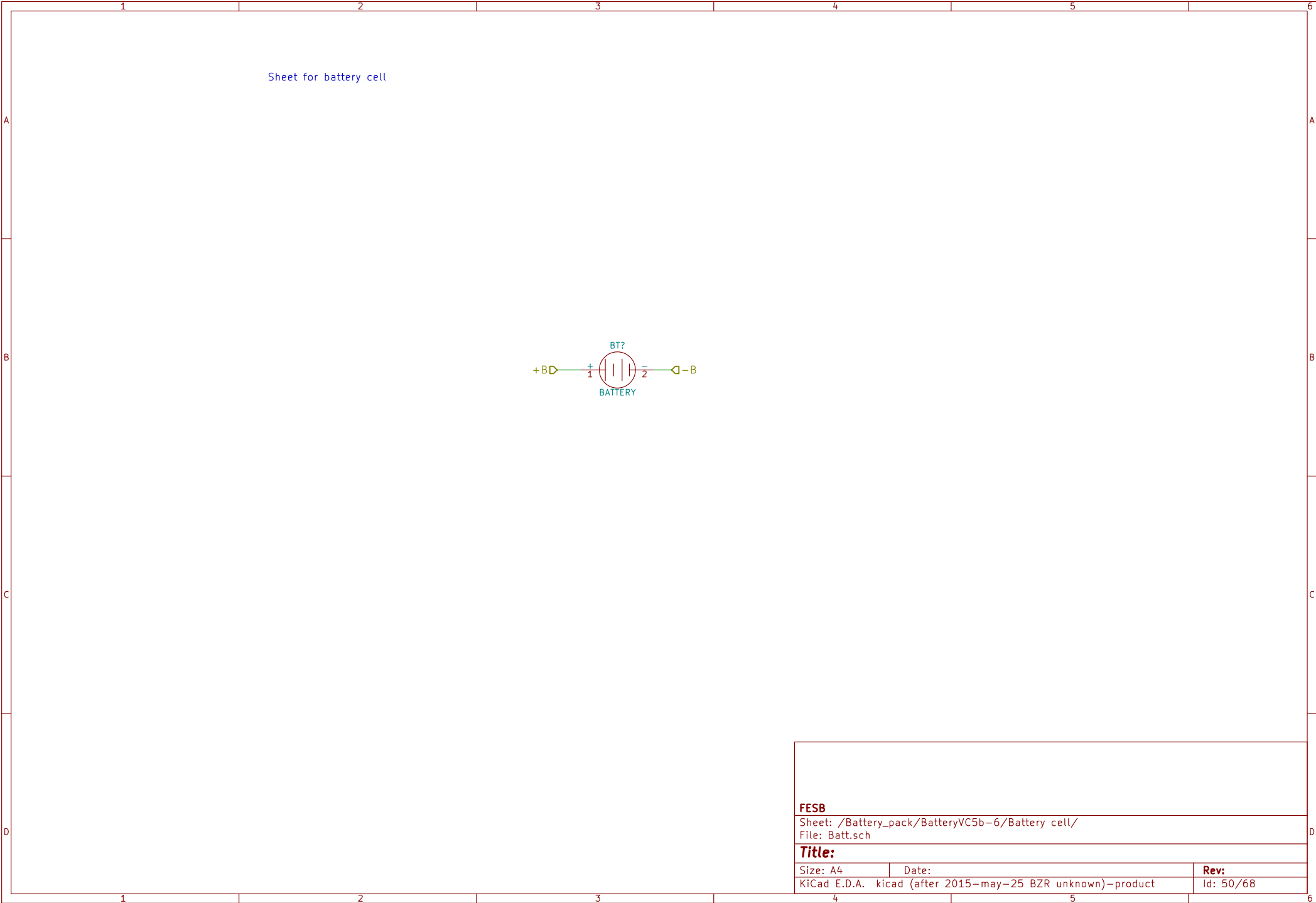
FESB

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File: Batt_ball_cap.sch

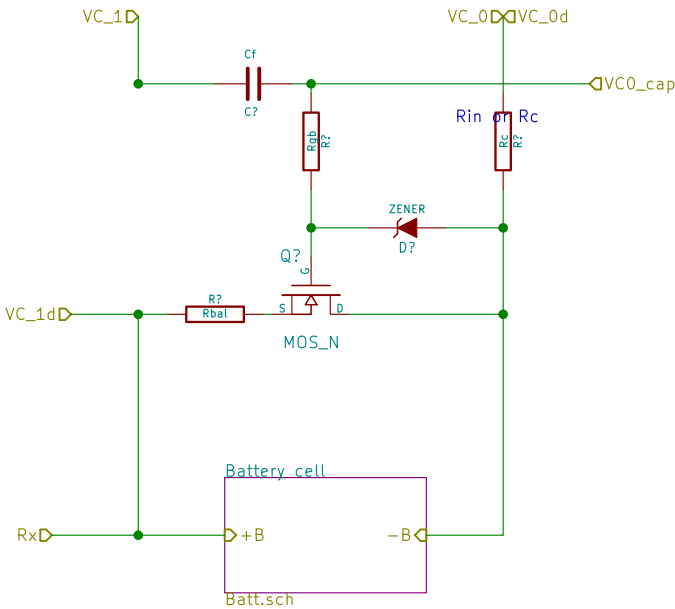
Title:

Size: A4 Date: KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev: Id: 49/68



This is just mesurment and balancing circuit



FESB

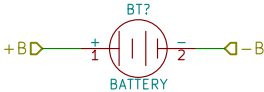
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File: Batt_ball_cap.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

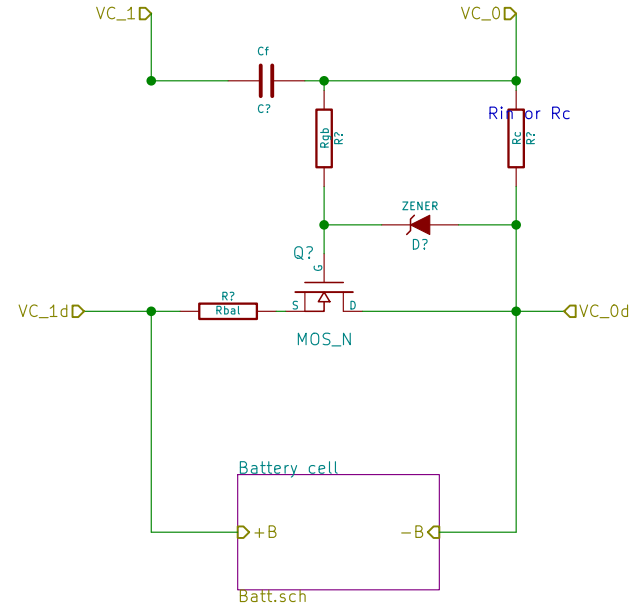
Rev:
Id: 51/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC0-1/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 52/68

This is just mesurment and balancing circuit



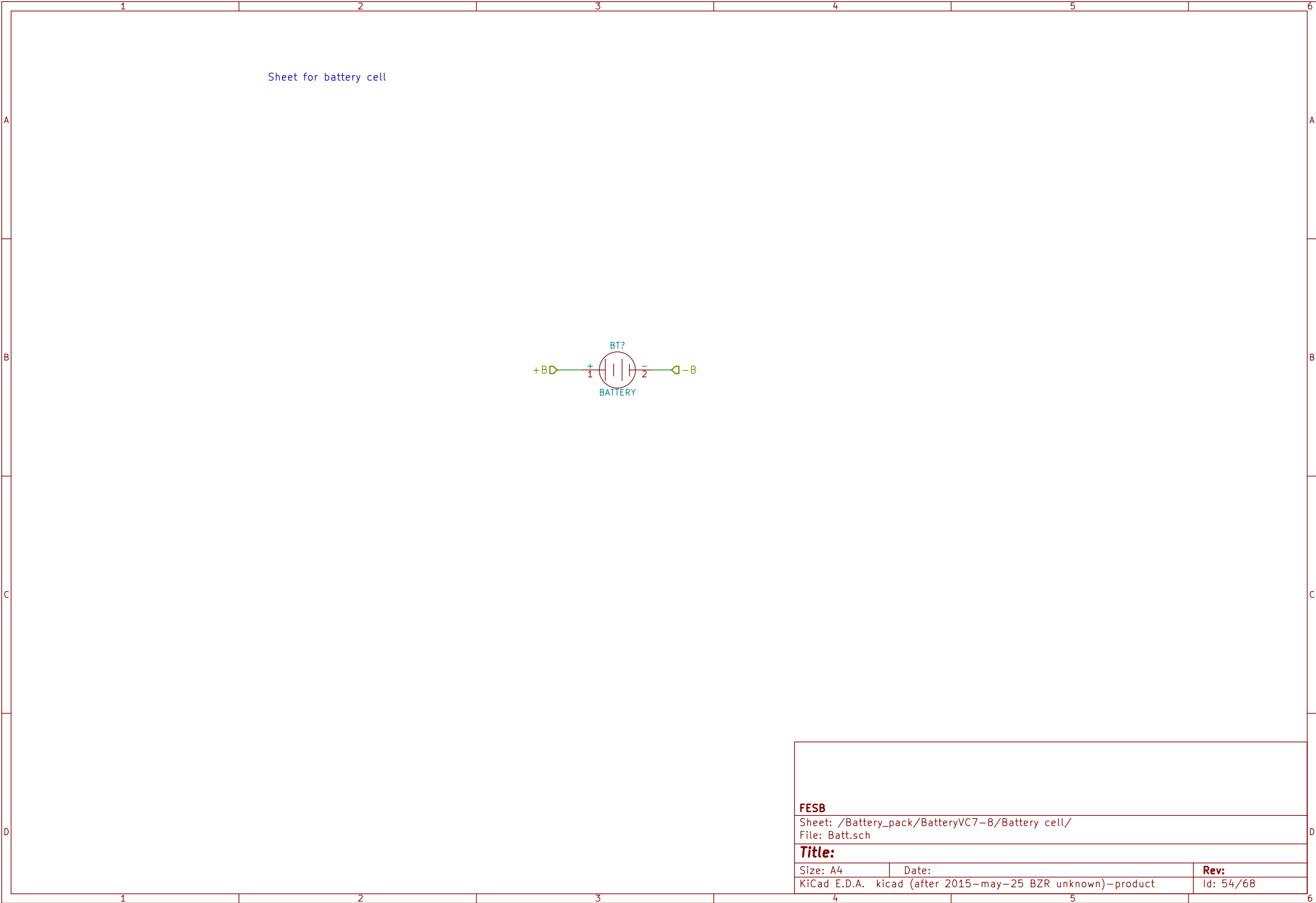
FESB

Sheet: /Battery_pack/BatteryVC7-8/
File: Batt_ball.sch

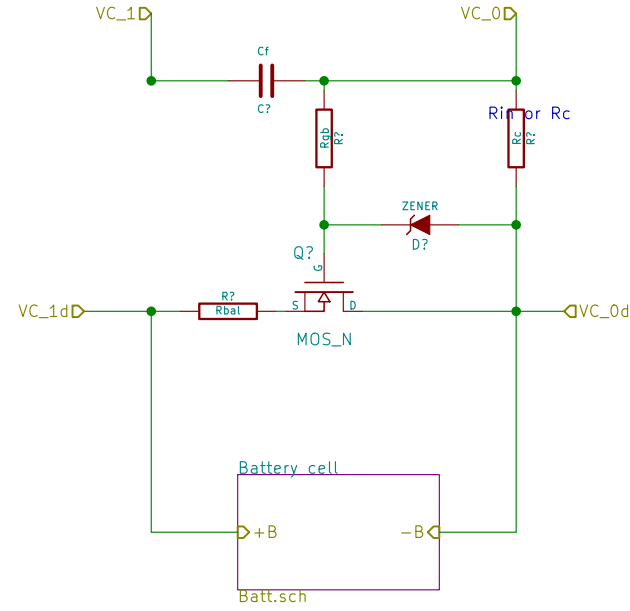
Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 53/68



This is just mesurment and balancing circuit



FESB

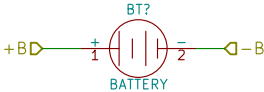
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File: Batt_ball.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

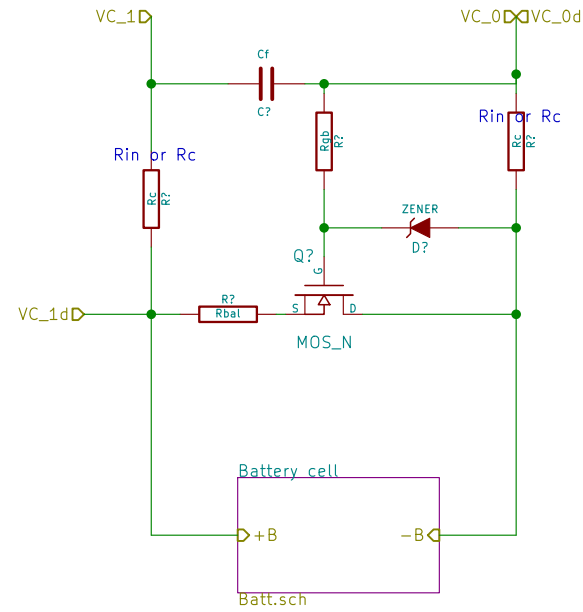
Rev:
Id: 55/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC8-9/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 56/68

This is just mesurment and balancing circuit



FESB

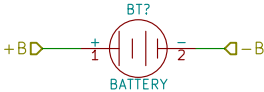
Sheet: /Battery_pack/BatteryVC9-10/
File: Batt_ball_end.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

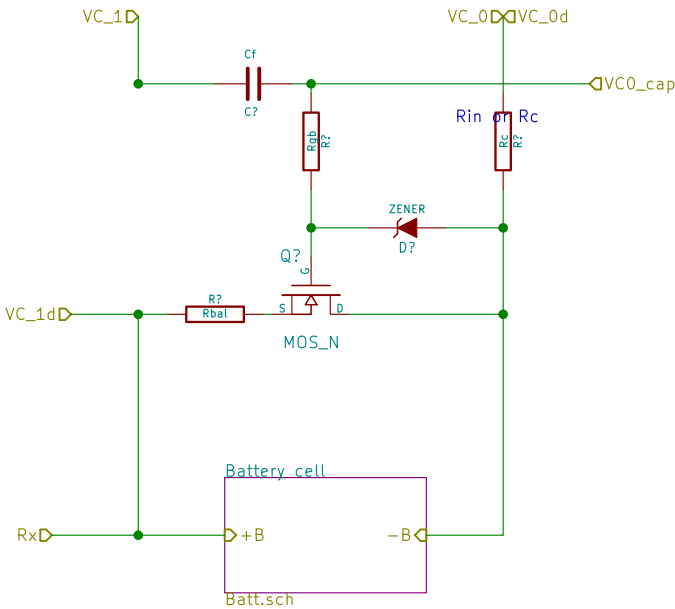
Rev:
Id: 57/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC9-10/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 58/68

This is just mesurment and balancing circuit



FESB

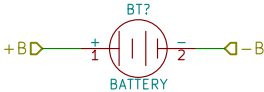
Sheet: /Battery_pack/BatteryVC10B-11/
File: Batt_ball_cap.sch

Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

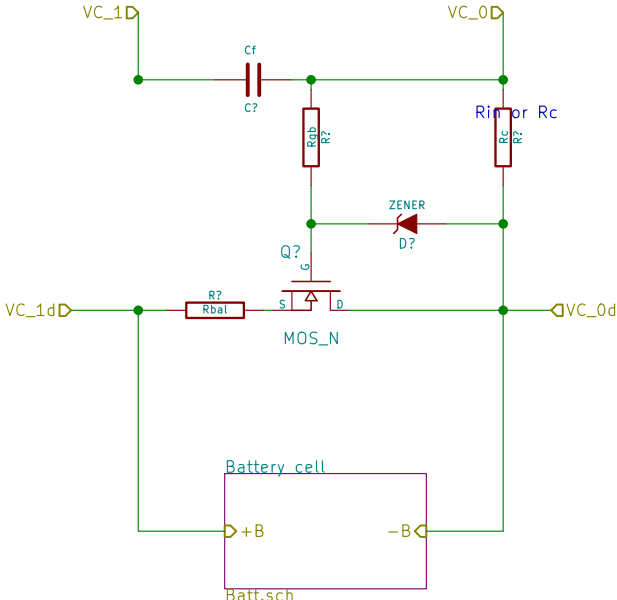
Rev:
Id: 59/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC10B-11/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 60/68

This is just measurement and balancing circuit



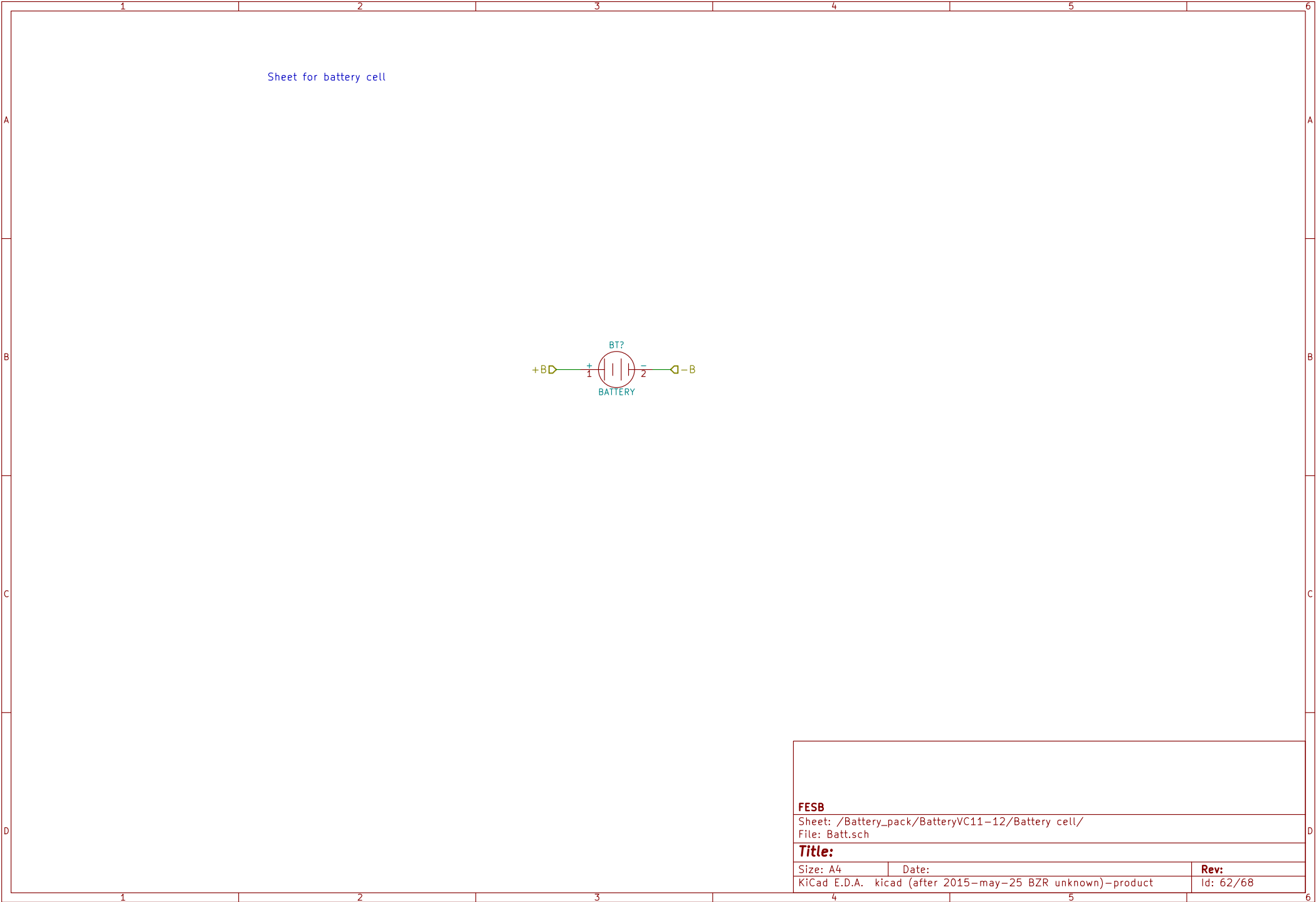
FESB

Sheet: /Battery_pack/BatteryVC11-12/
File: Batt_ball.sch

Title:

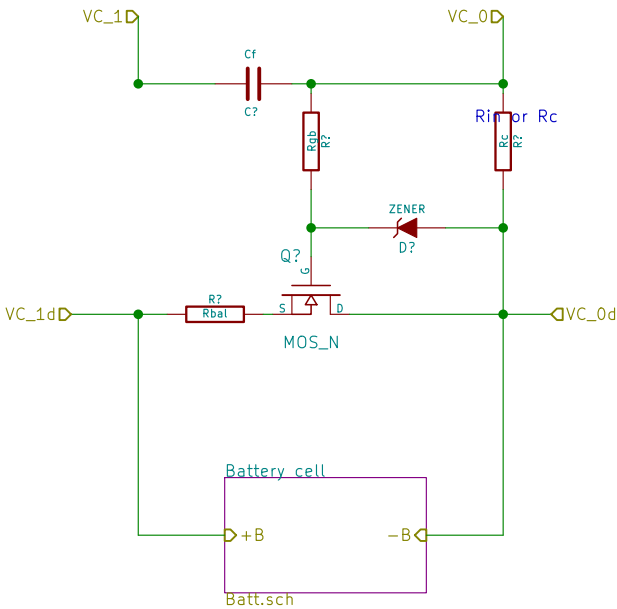
Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

Rev:
Id: 61/68



FESB		
Sheet: /Battery_pack/BatteryVC11-12/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 62/68

This is just mesurment and balancing circuit



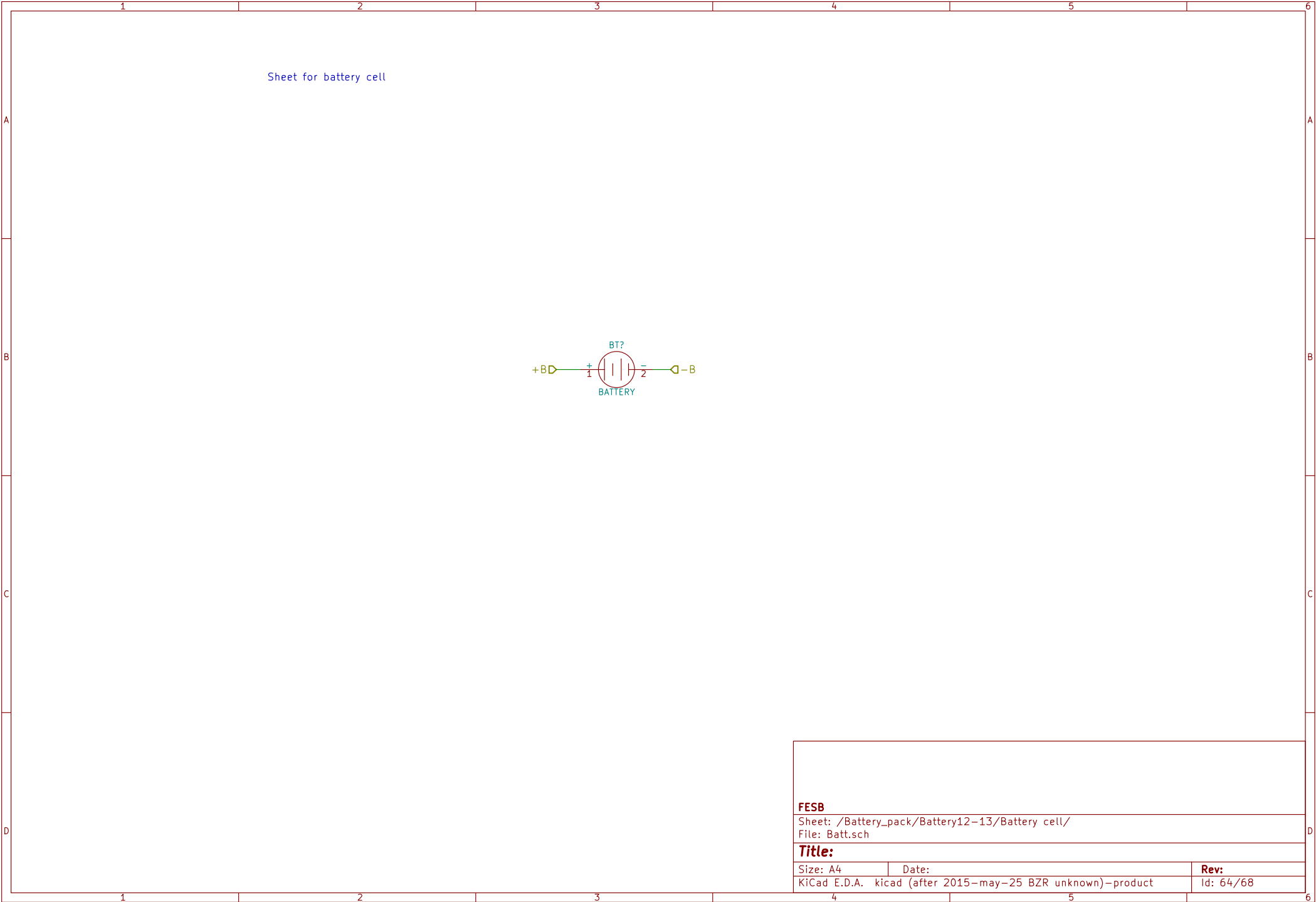
FESB

Sheet: /Battery_pack/Battery12-13/
File: Batt_ball.sch

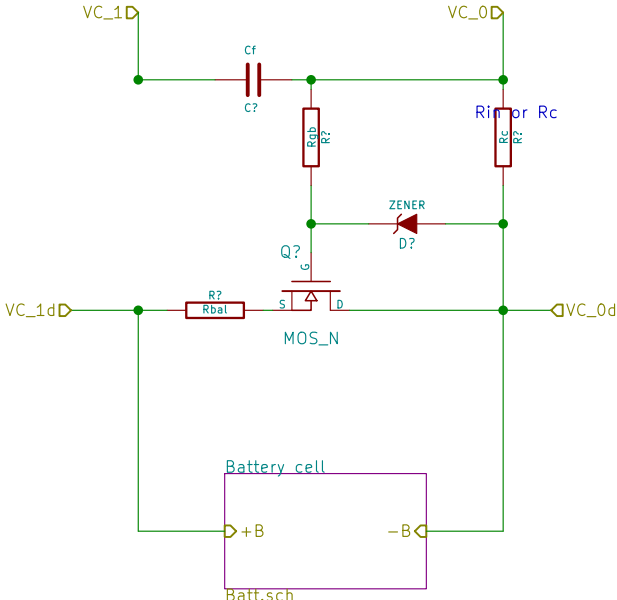
Title:

Size: A4 Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product

Rev:
Id: 63/68



This is just measurement and balancing circuit



FESB

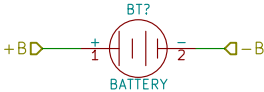
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File: Batt_ball.sch

Title:

Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

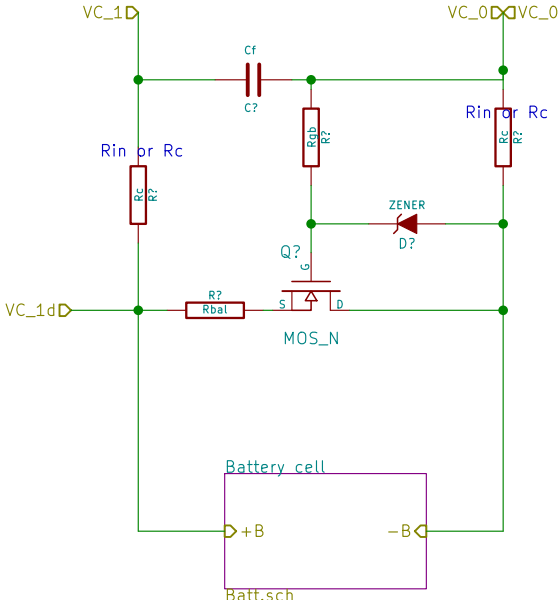
Rev:
Id: 65/68

Sheet for battery cell



FESB		
Sheet: /Battery_pack/BatteryVC13-14/Battery cell/		
File: Batt.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product		Id: 66/68

This is just measurement and balancing circuit



FESB

Sheet: /Battery_pack/BatteryVC14-15/
File: Batt_ball_end.sch

Title:

Size: A4	Date:
KiCad E.D.A. kicad (after 2015-may-25 BZR unknown)-product	

Rev:
Id: 67/68

