CMOS IC Application Note

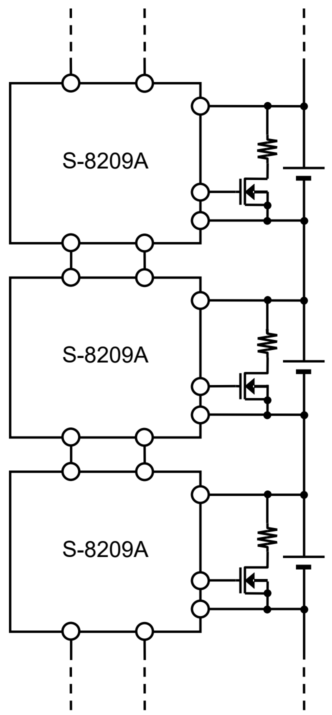
S-8209A Series Usage Guidelines Rev.2.0_00

The S-8209A Series is a battery protection IC with the cell-balance function.
This application note is a guideline on the typical connection examples when using the S-8209A Series for applications.
Refer to the datasheet for details and spec of this IC.

It is possible to configure the following applications with the S-8209A Series.

- A protection circuit with multi-serial cell; 2 cells or more
- A battery protection circuit with cell-balance function

• Protection circuit with S-8209A Series for multi-serial cell



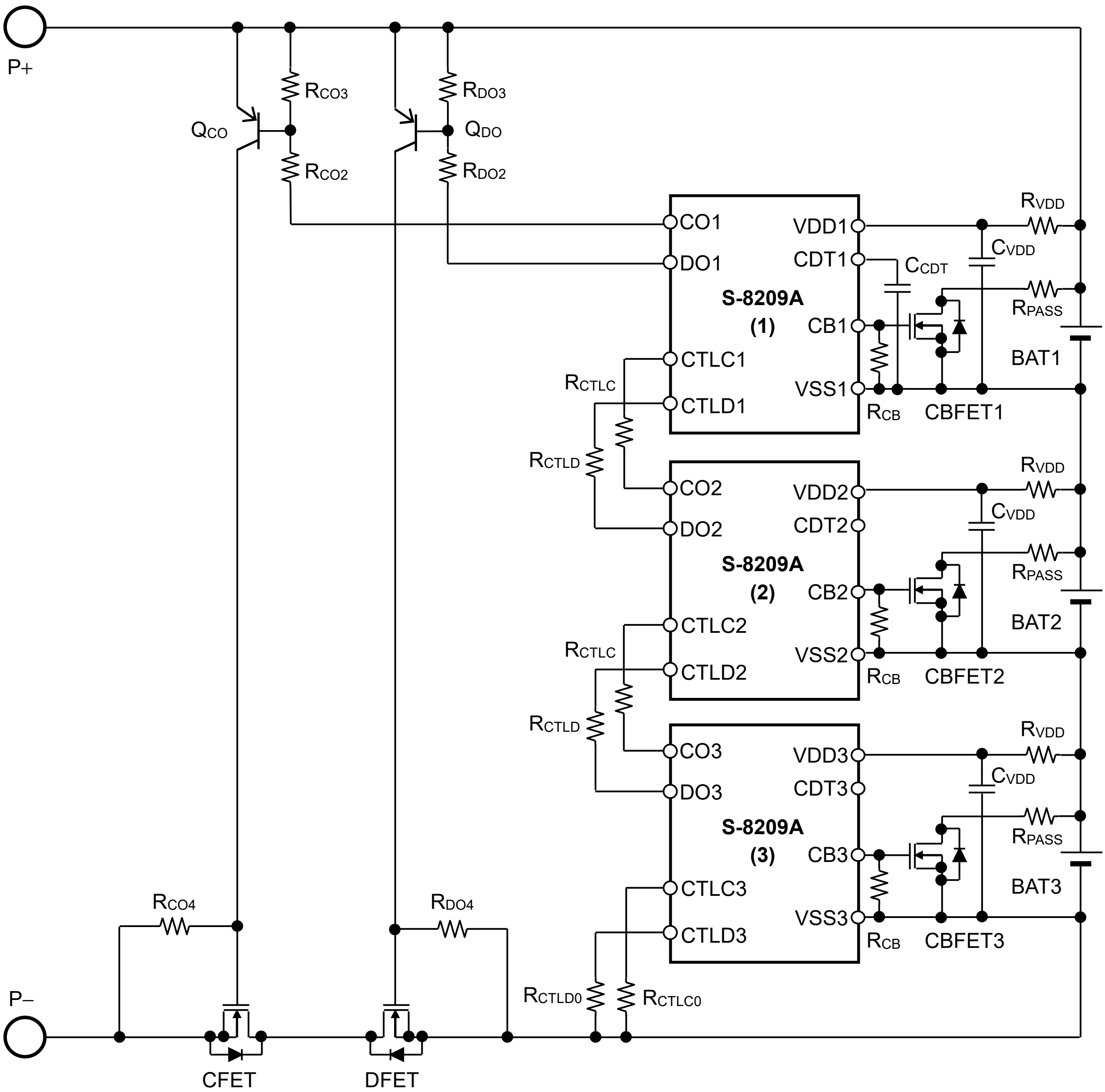
Contents

1. Protection circuit with S-8209A Series (without discharge cell-balance function) for multi-serial cell

In the connection of the S-8209A Series, connecting the CTLC, CTLD pins to the CO, DO pins allows to configure a protection circuit for serially connected batteries.

1. 1 Connection example of battery protection IC

Figure 1 shows the example of protection circuit with S-8209A Series for multi-serial cell.



Remark Refer to "**4. External components list**" for constants of external components.

Figure 1

Caution 1. The connection example may be changed without notice.

2. It has not been confirmed whether the operation is normal or not in circuits other than the connection example. In addition, the connection example and the constants do not guarantee proper operation. Perform thorough evaluation using the actual application to set the constants.

1. 2 Operation

Following is about the operation of protection circuit with S-8209A Series for multi-serial cell shown in **Figure 1**.

1. 2. 1 Normal status

Following is about the operation of S-8209A Series in the normal status.
The S-8209A goes in the normal status;
In the S-8209A (3), The CTLC3, CTLD3 pins are pulled down to the level of VSS3 pin, BAT3 is more than the overdischarge detection voltage (V_{DL}) and less than the overdischarge detection voltage (V_{CU}). The CO3, DO3 pins get the level of VSS3 pin.
In the S-8209A (2), The CTLC2, CTLD2 pins are pulled down to the level of VSS3 pin by the CO3, DO3 pins, BAT2 is more than V_{DL} and less than V_{CU}. The CO2, DO2 pins get the level of VSS2 pin.
In the S-8209A (1), The CTLC1, CTLD1 pins are pulled down to the level of VSS2 pin by the CO2, DO2 pins, BAT1 is more than V_{DL} and less than V_{CU}. The CO1, DO1 pins get the level of VSS1 pin.
The status of each pin in the normal status is shown in **Table 1**.

Table 1

CTLC pin	CTLD pin	Status of battery	CO pin	DO pin
CTLC3 = VSS3	CTLD3 = VSS3	V_{DL} < BAT3 < V_{CU}	CO3 = VSS3	DO3 = VSS3
CTLC2 = VSS3	CTLD2 = VSS3	V_{DL} < BAT2 < V_{CU}	CO2 = VSS2	DO2 = VSS2
CTLC1 = VSS2	CTLD1 = VSS2	V_{DL} < BAT1 < V_{CU}	CO1 = VSS1	DO1 = VSS1

The S-8209A (1) in the normal status turns on the charge control FET (CFET) and the discharge control FET (DFET) via bipolar transistors (Q_{CO}, Q_{DO}) externally set to each CO1 and DO1 pin. Therefore it is possible to charge/discharge by a charger or a load connected between P+ and P−.

1. 2. 2 Status to inhibit charge

Following is about the status to inhibit charge, for example, the S-8209A (3) detects overcharge, the S-8209A (2) and (1) are in the normal status.
The S-8209A (3) goes in the overcharge status when BAT3 gets V_{CU} or more by charging. The CO3 pin is set in high impedance.
The CTLC2 pin of the S-8209A (2) is pulled up to the level of VDD2 pin by the CTLC pin source current (I_{CTLCH}). The CTLC2 pin gets the level of VDD2 pin by the high impedance CO3 pin. Thus the S-8209A (2) goes in the overcharge status after the level of CTLC2 pin gets the CTLC pin H voltage (V_{CTLCH}) or more. The CO2 pin is set in high impedance.
The CTLC1 pin of the S-8209A (1) is pulled up to the level of VDD1 pin by I_{CTLCH} as well. The CTLC1 pin gets the level of VDD1 pin by the high impedance CO2 pin. The S-8209A (1) also goes in the overcharge status after the level of CTLC1 pin gets V_{CTLCH} or more.
The status of each pin in this case is shown in **Table 2**.

Table 2

CTLC pin	CTLD pin	Status of battery	CO pin	DO pin
CTLC3 = VSS3	CTLD3 = VSS3	$V_{CU} \leq$ BAT3	CO3 = High-Z	DO3 = VSS3
CTLC2 = VDD2	CTLD2 = VSS3	V_{DL} < BAT2 < V_{CU}	CO2 = High-Z	DO2 = VSS2
CTLC1 = VDD1	CTLD1 = VSS2	V_{DL} < BAT1 < V_{CU}	CO1 = High-Z	DO1 = VSS1

The S-8209A (1) in the overcharge status turns off the CFET via a bipolar transistor (Q_{CO}) set externally to the CO1 pin. In this case, charging via a charger connected between P+ and P– is inhibited.
By this operation the overcharge status is transmitted from the bottom (S-8209A (3)) to the top (S-8209A (1)), from the CO pin to the CTLC pin.

Charging is also inhibited; BAT1 or BAT2 gets V_{CU} or more.

1. 2. 3 Status to inhibit discharge

Following is the status to inhibit discharge, for example, the S-8209A (3) detects overdischarge, the S-8209A (2) and (1) are in the normal status.
The S-8209A (3) goes in the overdischarge status when BAT3 gets V_{DL} or less by discharging. The DO3 pin is set in high impedance.
The CTLD2 pin of the S-8209A (2) is pulled up to the level of VDD2 pin by the CTLD pin source current (I_{CTLDH}). The CTLD2 pin gets the level of VDD2 pin by the high impedance DO3 pin. Thus the S-8209A (2) goes in the overdischarge status after the level of CTLD2 pin gets the CTLD pin H voltage (V_{CTLDH}) or more. The DO2 pin is set in high impedance.
The CTLD1 pin of the S-8209A (1) is pulled up to the level of VDD1 pin by I_{CTLDH} as well. The CTLD1 pin gets the level of VDD1 pin by the high impedance DO2 pin. The S-8209A (1) also goes in the overdischarge status after the level of CTLD1 pin gets V_{CTLDH} or more.
The status of each pin in this case is shown in **Table 3**.

Table 3

CTLC pin	CTLD pin	Status of battery	CO pin	DO pin
CTLC3 = VSS3	CTLD3 = VSS3	BAT3 ≤ V_{DL}	CO3 = VSS3	DO3 = High-Z
CTLC2 = VSS3	CTLD2 = VDD2	V_{DL} < BAT2 < V_{CU}	CO2 = VSS2	DO2 = High-Z
CTLC1 = VSS2	CTLD1 = VDD1	V_{DL} < BAT1 < V_{CU}	CO1 = VSS1	DO1 = High-Z

The S-8209A (1) in the overdischarge status turns off the DFET via a bipolar transistor (Q_{DO}) externally set to the DO1 pin. In this case, discharging to a load connected between P+ and P– is inhibited.
By this operation the overdischarge status is transmitted from the bottom (S-8209A (3)) to the top (S-8209A (1)), from the DO pin to the CTLD pin.

Discharging is also inhibited; BAT1 or BAT2 gets V_{DL} or less.

1. 2. 4 Charge cell-balance function

In **Figure 1**, The S-8209A (3) sets the CB3 pin at the level of VDD3 pin when BAT3 gets the cell-balance detection voltage (V_{BU}) or more by charging. By this operation, the cell-balance control FET (CBFET3) is turned on so that the cell-balance control FET bypasses the charge current which flows into BAT3.
At this point, if BAT1, BAT2 are less than V_{BU}, the speed to charge BAT3 gets slower than to charge BAT1, BAT2. This is the charge cell-balance function. Even if any of battery voltages reaches V_{BU}, the cell-balance control FET which corresponds to each battery turns on and the cell-balance is adjusted.
The S-8209A Series turns off the cell-balance control FET when the battery voltage decreases to the cell-balance release voltage (V_{BL}) or less by discharging again.

Caution If a battery having the voltage V_{BL} or more is included among batteries when composing a protection circuit shown in Figure 1, the cell-balance control FET may turn on immediately after connecting the batteries.

1. 2. 5 Delay circuit

Connecting a delay capacitor only to the CDT1 pin of the S-8209A (1), as seen in **Figure 1**, allows to gain the detection delay time (t_{DET}) and the release delay time (t_{REL}). In detecting by any of batteries, each delay time is the same length.

(1) Detection delay time (t_{DET})

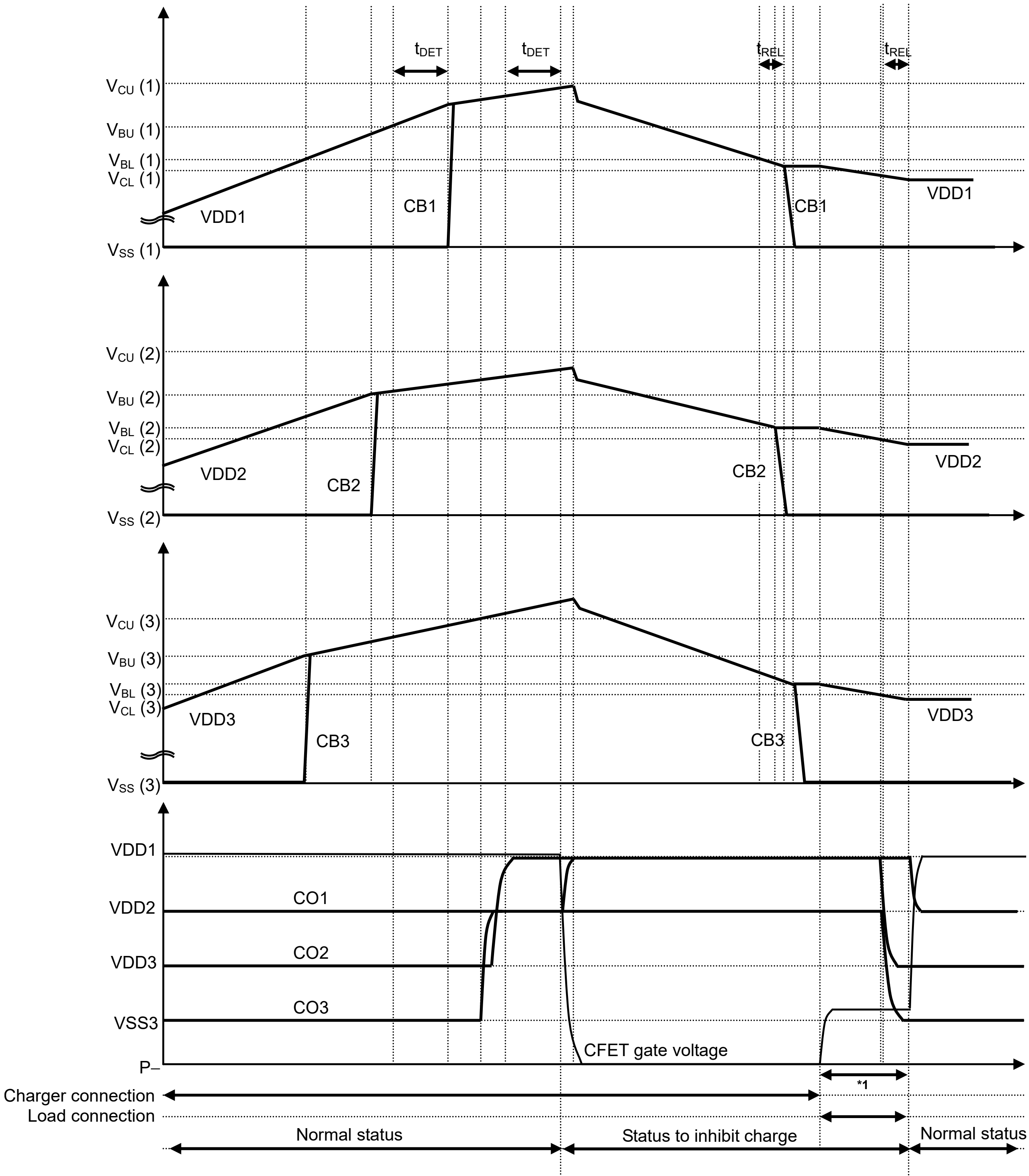
BAT3 gets V_{CU} or more by charging, the CTLC2 pin gets the level of VDD2 pin because a capacitor is not connected to the CDT3 pin so that the CO3 pin is set in high impedance after delay of several hundred μs.
After that in the S-8209A (2), the level of CTLC2 pin gets V_{CTLCH} or more, after delay of several hundred μs the CO2 pin is set in high impedance.
In the S-8209A (1), after delay of 10.0 [MΩ] (typ.) × 0.01 [μF] = 0.1 [s] (typ.), the CO1 pin is set in high impedance because connected C_{CDT} to the CDT1 pin.
Even if any of batteries detects, by this operation, users are able to gain the detection delay time almost the same to delay time of the S-8209A (1), because it defines the whole delay time in the S-8209A Series.

(2) Release delay time (t_{REL})

The S-8209A Series also has the release delay time (t_{REL}), and this delay time is set its length as approx. 1/10 of the detection delay time. Connecting a delay capacitor only to the CDT1 pin of the S-8209A (1) allows having the same release delay time, as well as in the detection delay time.

1. 3 Timing chart

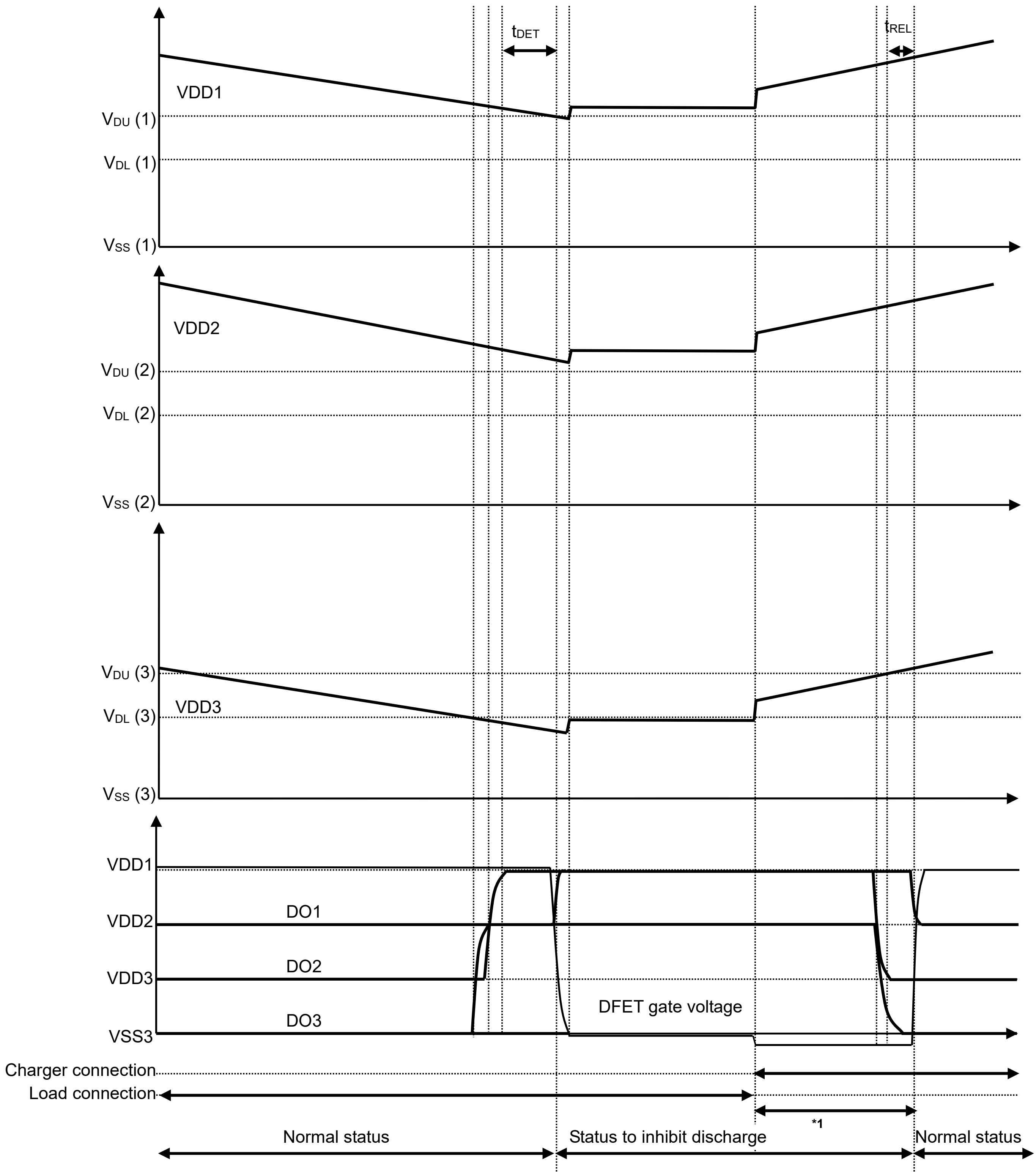
1. 3. 1 Overcharge detection



***1.** In this period, the discharge current flows via a parasitic diode in the CFET.

Figure 2

1. 3. 2 Overdischarge detection



***1.** In this period, the charge current flows via a parasitic diode in the DFET.

Figure 3

1. 4 Demonstration data of charge cell-balance detection

The demonstration data shows cell-balance for 3-serial lithium ion rechargeable battery using the S-8209AAA.

1. 4. 1 High ratio of bypass current to charge current

Charger: a constant current charger (0.05 C = 145 mA)

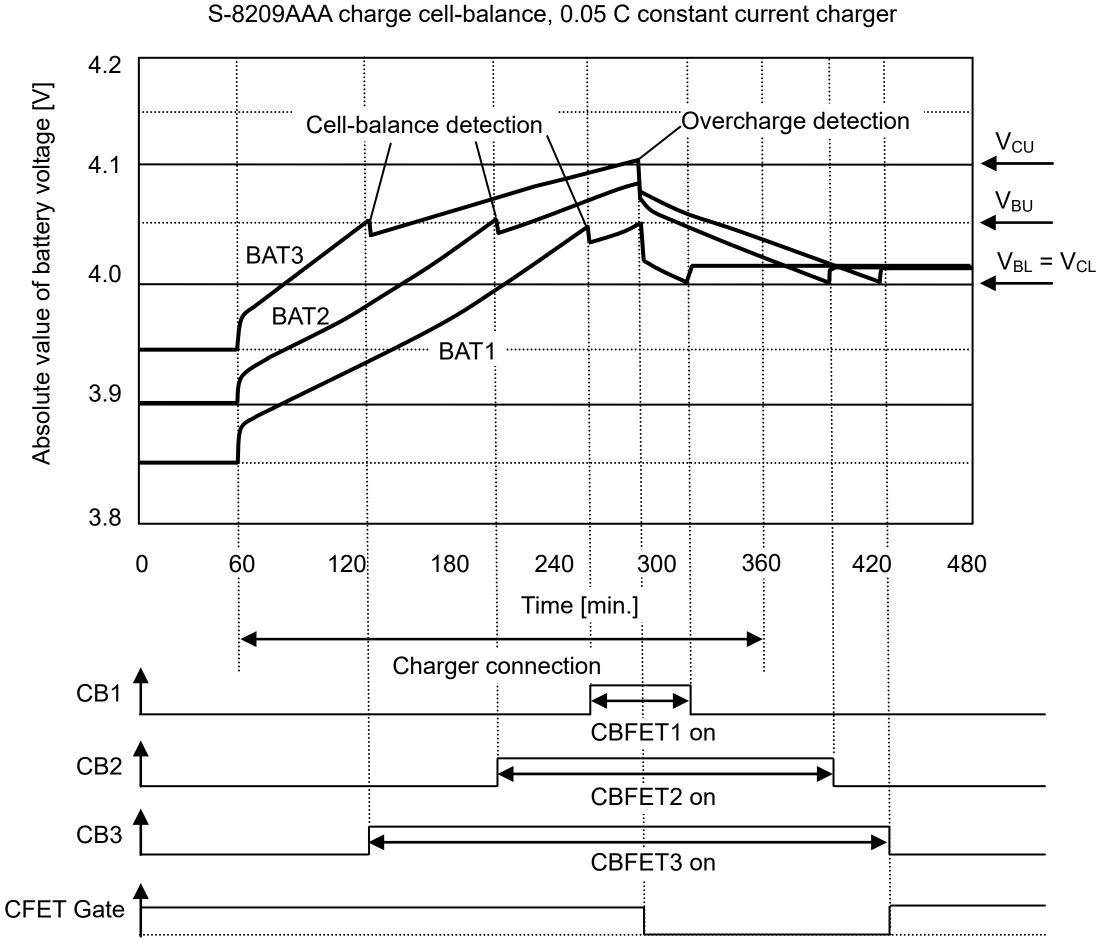


Figure 4

Test conditions

Test circuit: **Figure 1**

IC: S-8209AAA (V_{CU} = 4.100 V, V_{CL} = 4.000 V, V_{BU} = 4.050 V, V_{BL} = 4.000 V, V_{DL} = 2.500 V, V_{DU} = 2.700 V)

Battery: 3-serial cell Lithium ion rechargeable battery, Nominal capacitance: 2.9 Ah, Size: 18650

R_{PASS}: 51 Ω (1 W) → Bypass current = 4.1 V / 51 Ω = 80 mA

1. 4. 2 Low ratio of bypass current to charge current

When the ratio of bypass current to charge current is low, repeating cell-balance cycle enables to adjust cell-balance.
Charger: a constant current charger (0.1 C = 290 mA)

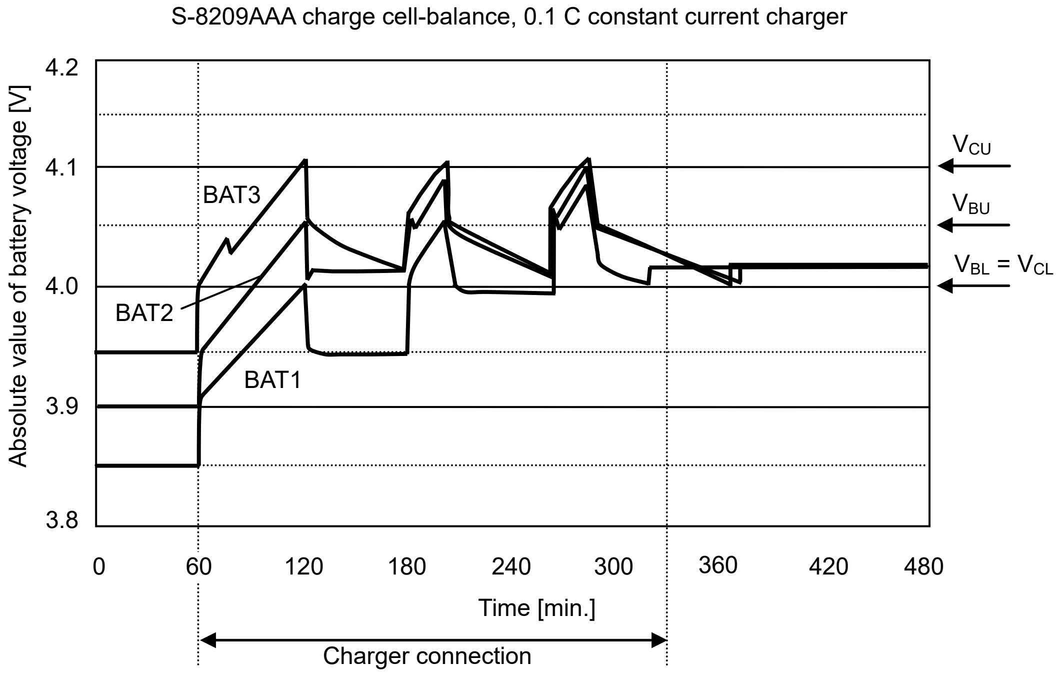


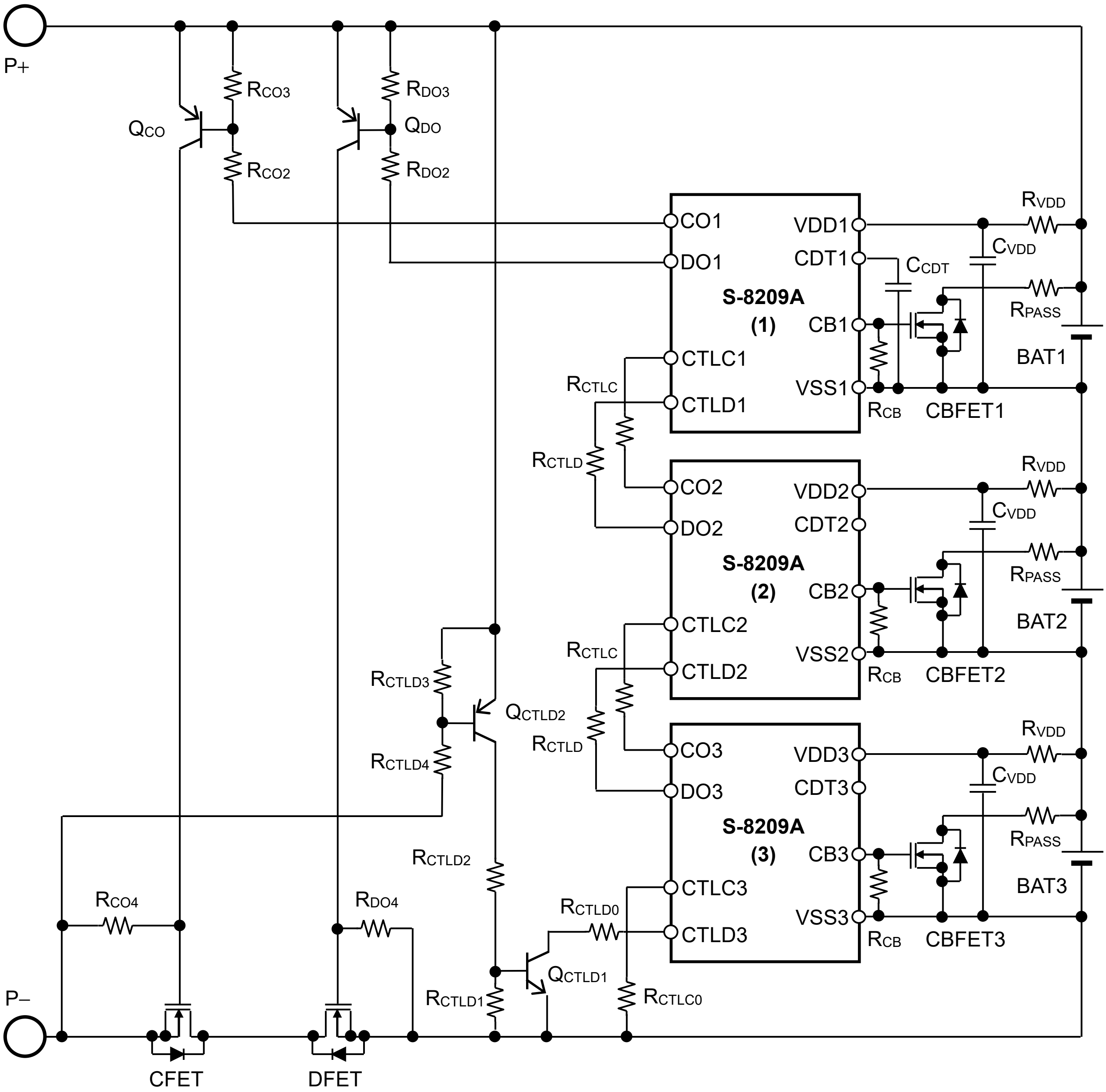
Figure 5

Test conditions
Test circuit: **Figure 1**
IC: S-8209AAA (V_{CU} = 4.100 V, V_{CL} = 4.000 V, V_{BU} = 4.050 V, V_{BL} = 4.000 V, V_{DL} = 2.500 V, V_{DU} = 2.700 V)
Battery: 3-serial cell lithium ion rechargeable battery, Nominal capacitance: 2.9 Ah, Size: 18650
R_{PASS}: 51 Ω (1 W) → bypass current = 4.1 V / 51 Ω = 80 mA

2. Protection circuit with S-8209A Series (with discharge cell-balance function) for multi-serial cell

2. 1 Connection example of battery protection IC

Setting bipolar transistors (Q_{CTLD1}, Q_{CTLD2}) allows adding the function to transmit the overdischarge status from the top (S-8209A (1)) to the bottom (S-8209A (3)).



Remark Refer to "**4. External components list**" for constants of external components.

Figure 6

Caution 1. The connection example may be changed without notice.

2. It has not been confirmed whether the operation is normal or not in circuits other than the connection example. In addition, the connection example and the constants do not guarantee proper operation. Perform thorough evaluation using the actual application to set the constants.

2. 2 Operation

Following is about the operation of protection circuit with S-8209A Series for multi-serial cell shown in **Figure 6**.
Setting bipolar transistors (Q_{CTLD1}, Q_{CTLD2}) to the circuit in **Figure 6** allows adding the function to transmit the overdischarge status from the top (S-8209A (1)) to the bottom (S-8209A (3)). By this, even if any IC among the S-8209A (1) to (3) first goes in the overdischarge status, it is possible to turn on all other cell-balance control FETs (CBFET) of the S-8209A Series. Thus cell-balance is certainly adjusted.

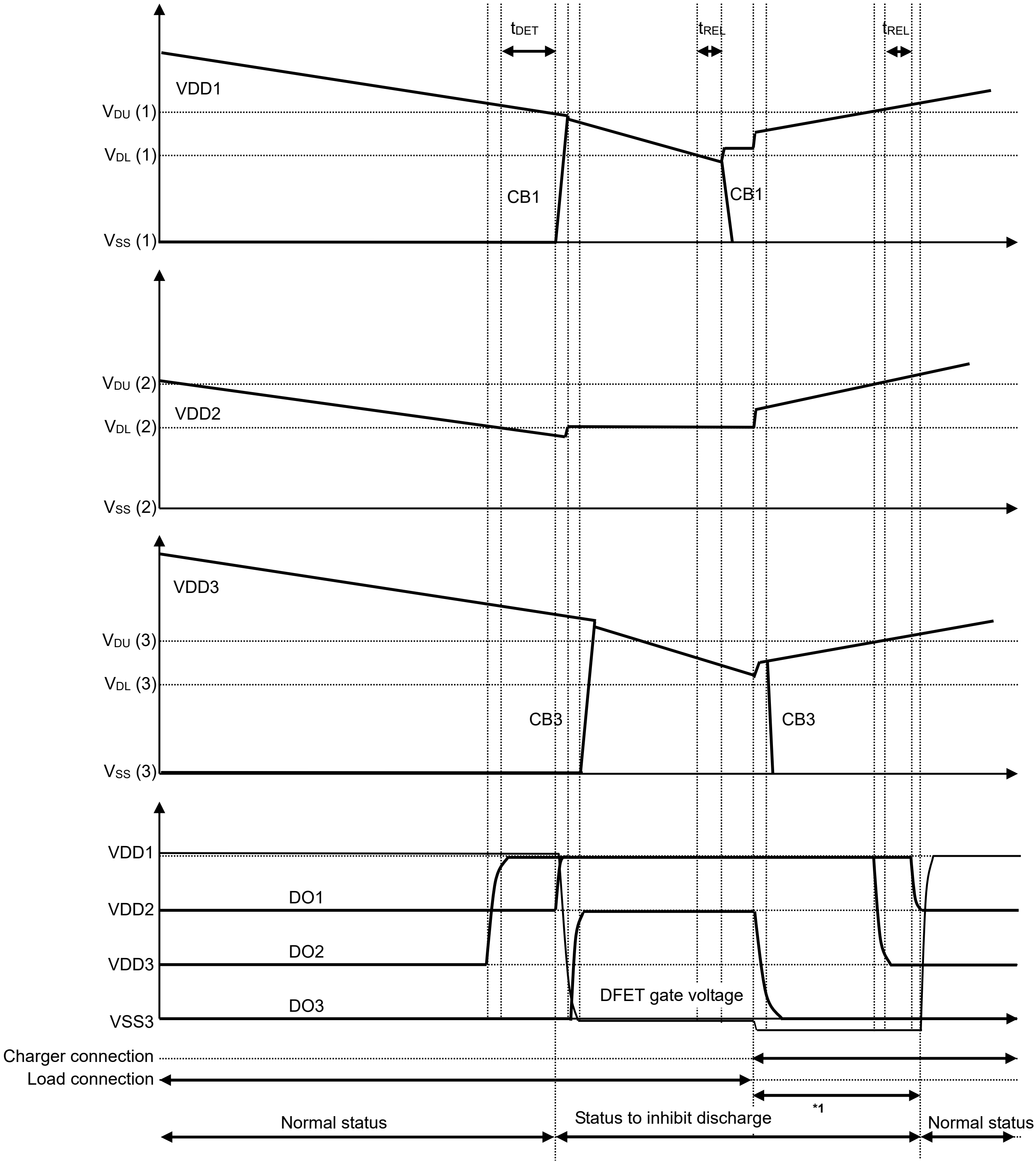
Following is about the operation in the status to inhibit discharge, when the S-8209A (2) detects overdischarge, and the S-8209A (1), (3) are in the normal status.

1. The S-8209A (2) goes in the overdischarge status when BAT2 decreases to V_{DL} or less by discharging. The DO2 pin is set in high impedance.
2. The S-8209A (1) also goes in the overdischarge status via the DO2 pin to the CTLD1 pin.
3. The S-8209A (1) turns on the cell-balance control FET (CBFET1) by the discharge cell-balance function.
4. The S-8209A (1) in the overdischarge status turns off DFET via a bipolar transistor (Q_{DO}) and inhibits discharging to a load connected between P+ and P−.
5. The P− pin is pulled up by a load connected between P+ and P−.
6. Q_{CTLD1}, Q_{CTLD2} are turned off and the CTLD3 pin of the S-8209A (3) is set in high impedance.
7. The S-8209A (3) also goes in the overdischarge status. The cell-balance control FET (CBFET3) turns on by the discharge cell-balance function.

As mentioned above, even in case that the S-8209A (2) first detects overdischarge by voltage drop in BAT2, the overdischarge status is transmitted from the S-8209A (1) to S-8209A (3) via Q_{CTLD1}, Q_{CTLD2}. As a result all (1) to (3) of the S-8209A go in the overdischarge status so that cell-balance is adjusted by the discharge cell-balance function, when each BAT is more than V_{DL}. The cell-balance FET which corresponds to each battery turns off by the voltages of BAT1 to 3 that decreased to V_{DL} or less.
And Q_{CTLD1}, Q_{CTLD2} are turned on by connecting a charger between P+ and P− after inhibit discharging, and the CTLD3 pin is pulled down to the level of VSS3 pin. In this case, the cell-balance control FET (CBFET3) turns off although the voltage of BAT3 does not reach V_{DL} or less.

Caution If a battery having the voltage V_{BL} or more, or a battery having the overdischarge release voltage (V_{DU}) or less is not included among batteries when composing a protection circuit shown in Figure 6, the cell-balance control FET may turn on immediately after connecting the battery. To turn off the cell-balance control FET, connect a charger between P+ and P−.

2. 3 Timing chart of overdischarge detection



***1.** In this period, the charge current flows via a parasitic diode in the DFET.

Figure 7

2. 4 Demonstration data of discharge cell-balance detection

The demonstration data shows cell-balance for 3-serial lithium ion rechargeable battery using the S-8209AAA.

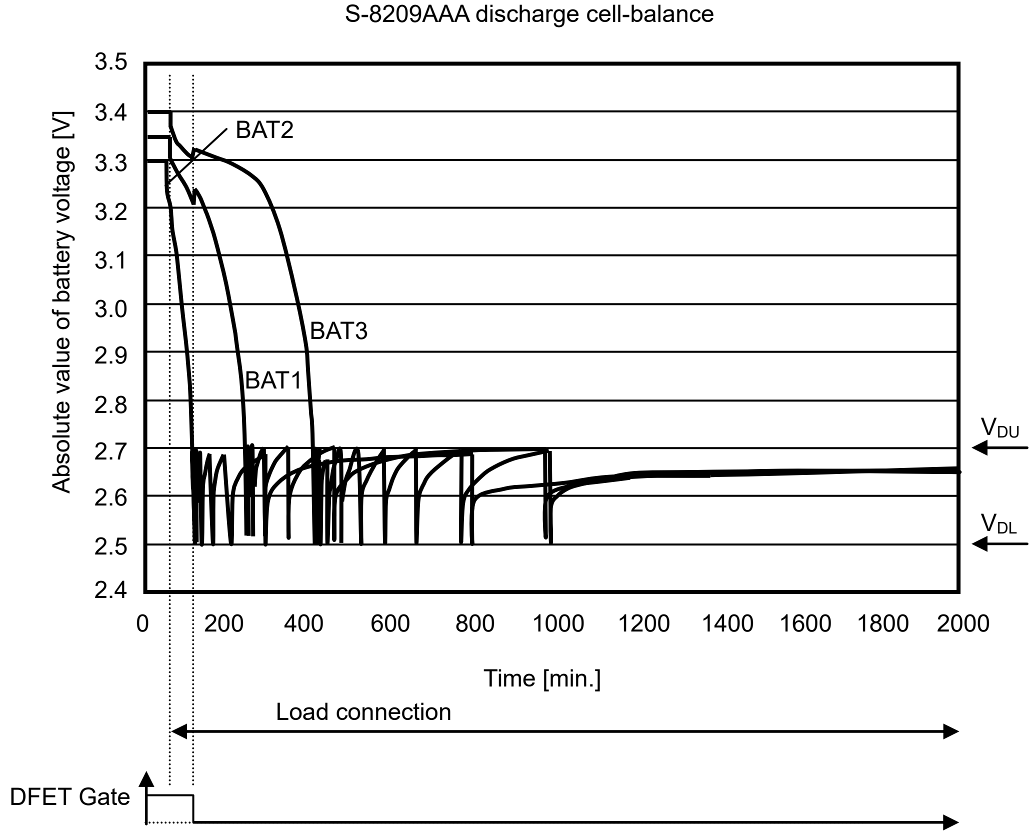


Figure 8

Test conditions
Test circuit: **Figure 6**
IC: S-8209AAA (V_{CU} = 4.100 V, V_{CL} = 4.000 V, V_{BU} = 4.050 V, V_{BL} = 4.000 V, V_{DL} = 2.500 V, V_{DU} = 2.700 V)
Battery: 3-serial cell lithium ion rechargeable battery, Nominal capacitance: 2.9 Ah, Size: 18650
R_{PASS}: 51 Ω (1 W) → bypass current = 2.5 V / 51 Ω = 49 mA
Load: 100 Ω

Battery voltage's oscillation

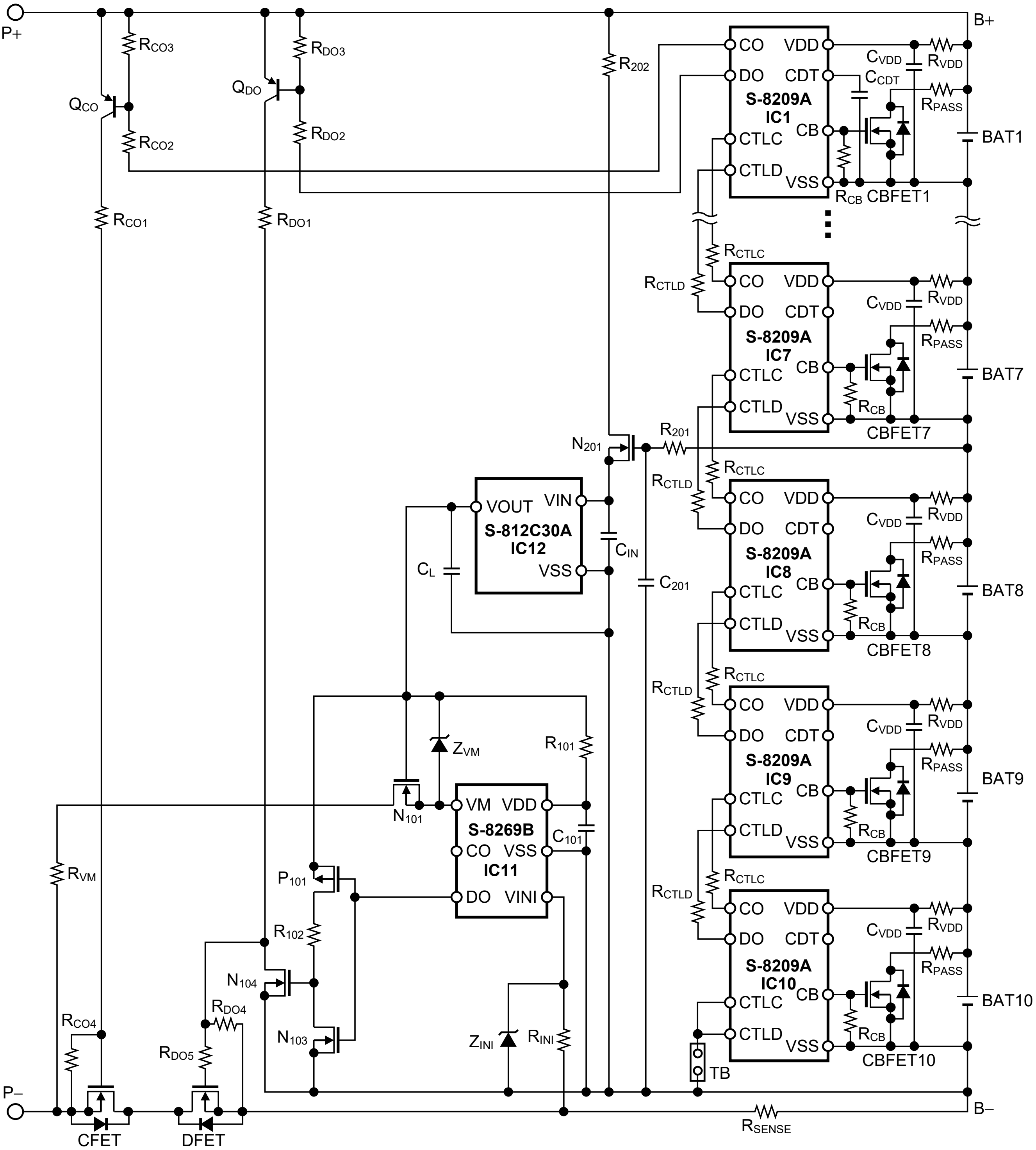
1. The cell-balance control FET turns off when the battery voltage decrease to the overdischarge detection voltage (V_{DL}) or less.
2. Discharge via the cell-balance control FET stops so that the battery voltage rises.
3. The cell-balance control FET turns on when the battery voltage increases to the overdischarge release voltage (V_{DU}) or more.
4. Discharge via the cell-balance control FET starts so that the battery voltage falls.

Repeating the procedures 1 to 4 enables to adjust cell-balance.

3. Examples of application circuit

The circuit examples shown in **Figure 9** to **Figure 11** are recommended when a low-resistance SENSE resistor is used. These circuits enable accurate overcurrent protection.

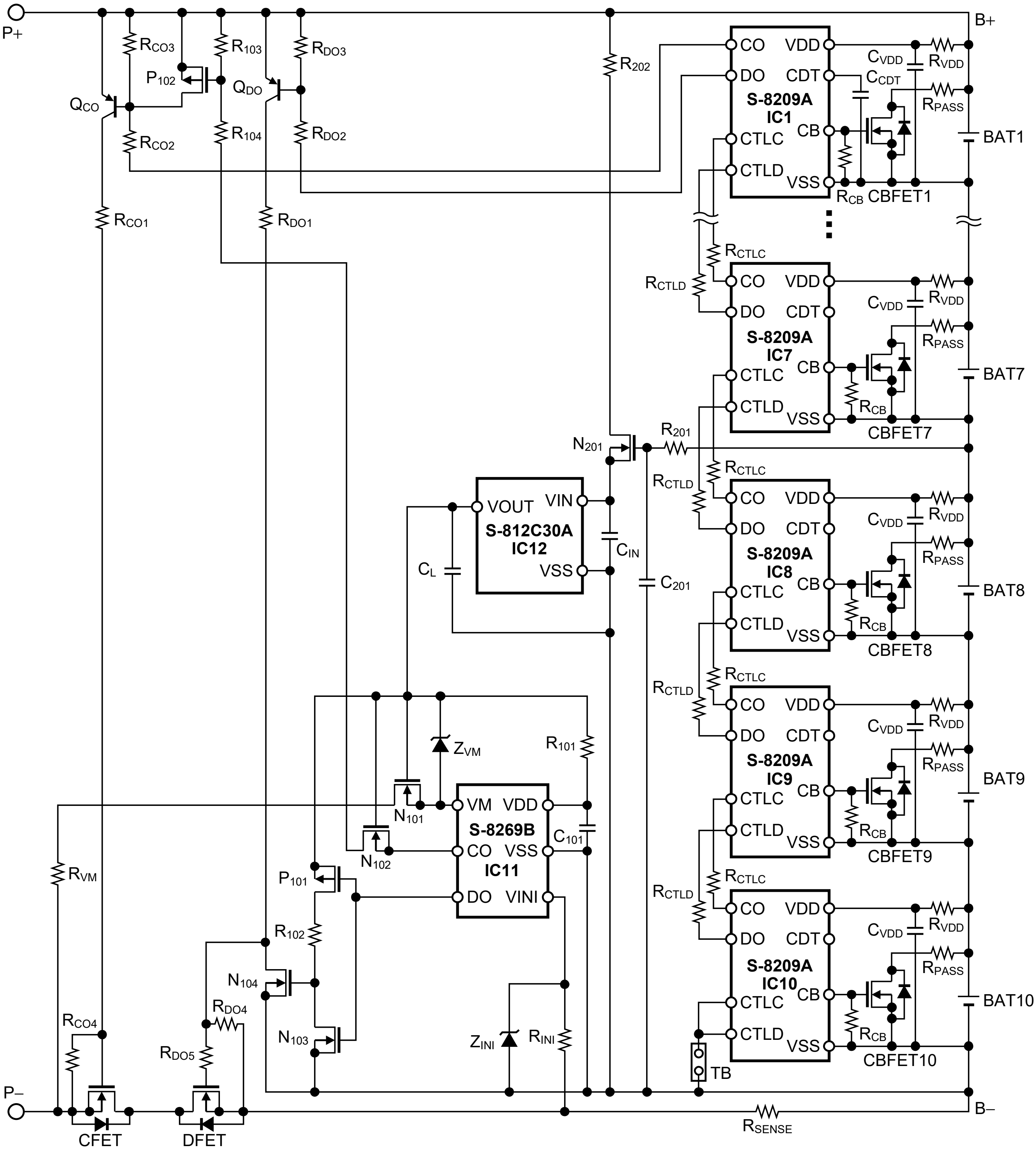
3. 1 10-serial cell protection circuit added the discharge overcurrent protection function (Charge pin and discharge pin are integrated, S-8269B Series)



Remark Refer to "**4. External components list**" for constants of external components.

Figure 9

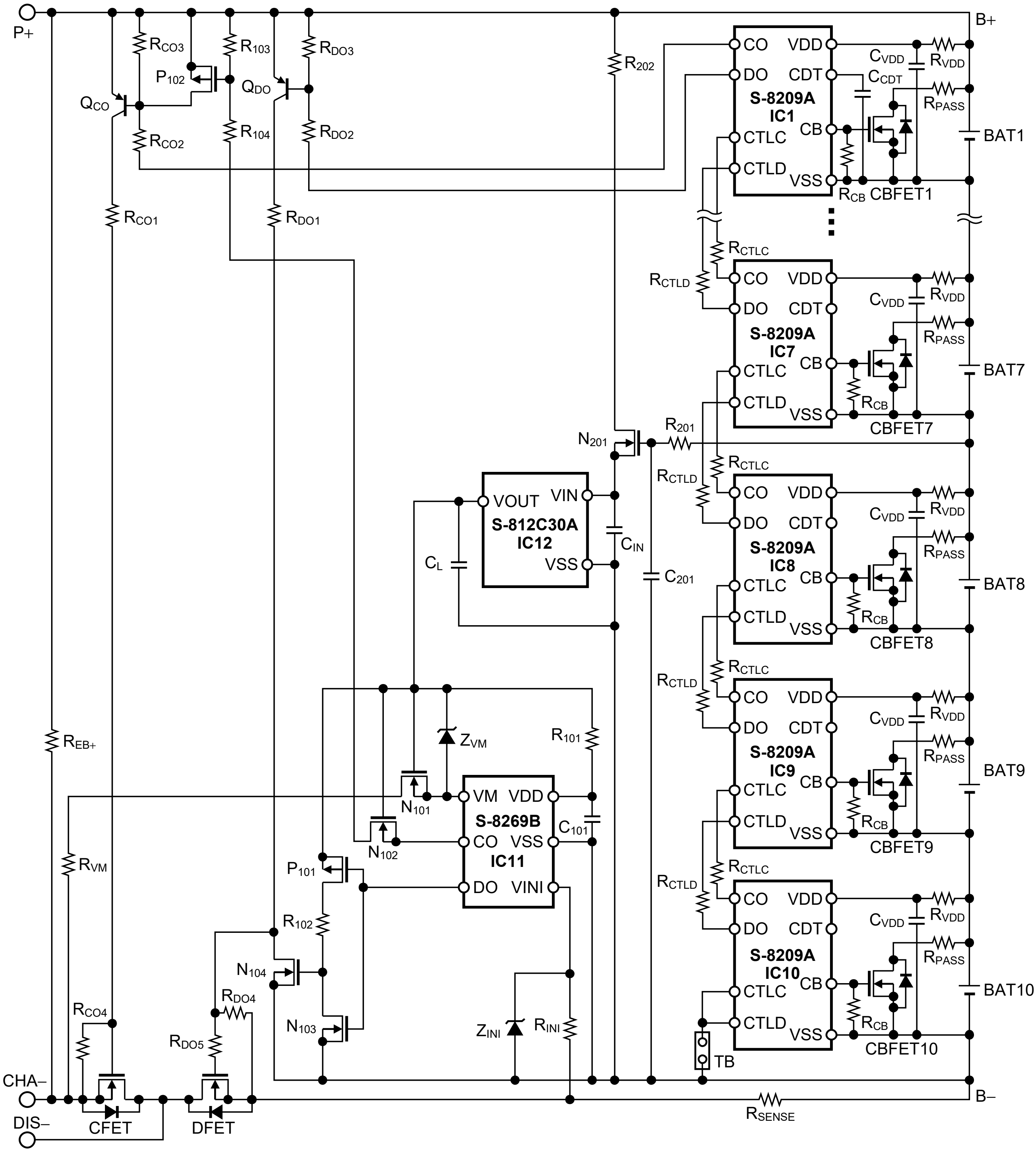
3. 2 10-serial cell protection circuit added the charge and discharge overcurrent protection functions (Charge pin and discharge pin are integrated, S-8269B Series)



Remark Refer to "**4. External components list**" for constants of external components.

Figure 10

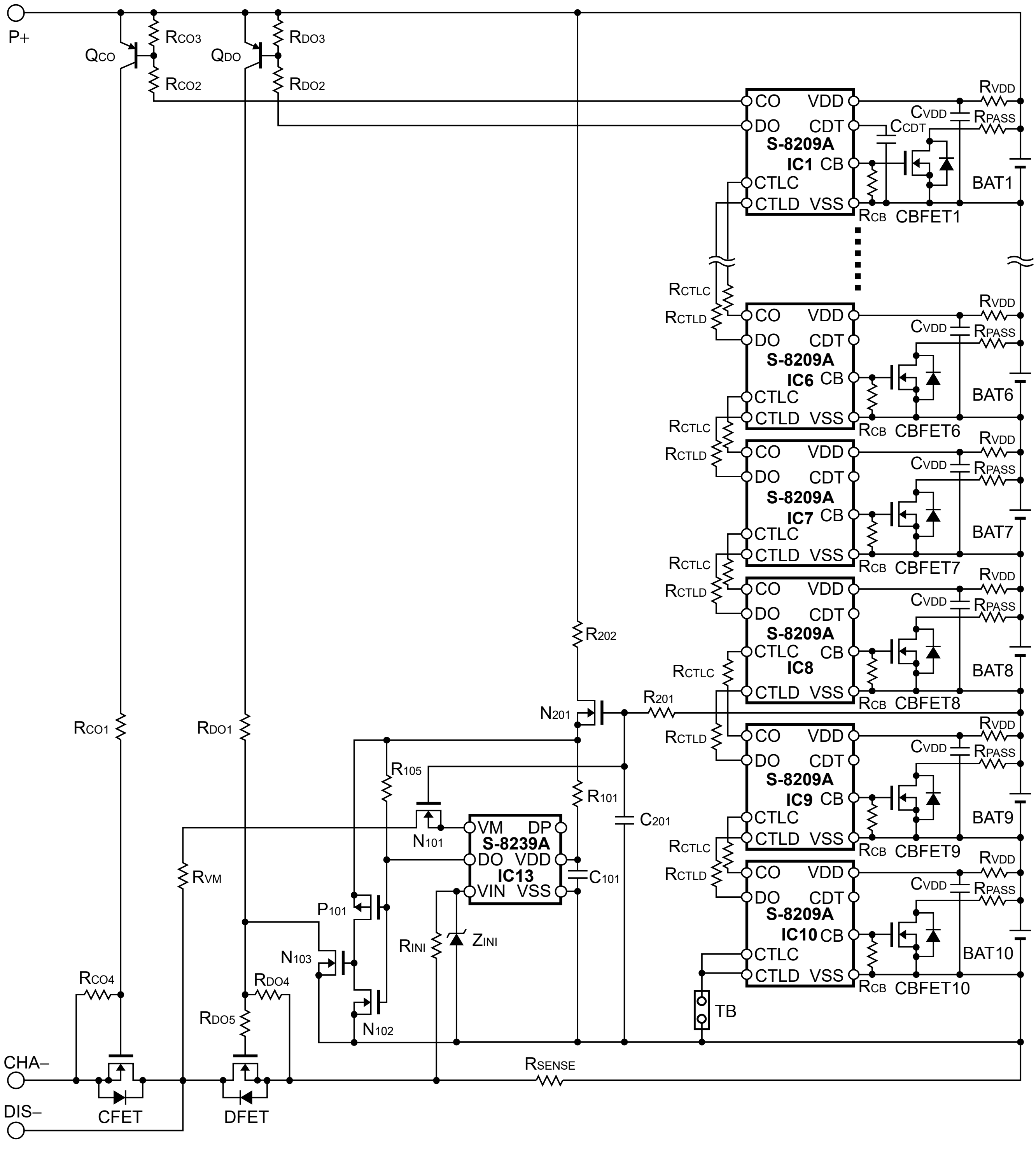
3. 3 10-serial cell protection circuit added the charge and discharge overcurrent protection functions (Charge pin and discharge pin are separated, S-8269B Series)



Remark Refer to "**4. External components list**" for constants of external components.

Figure 11

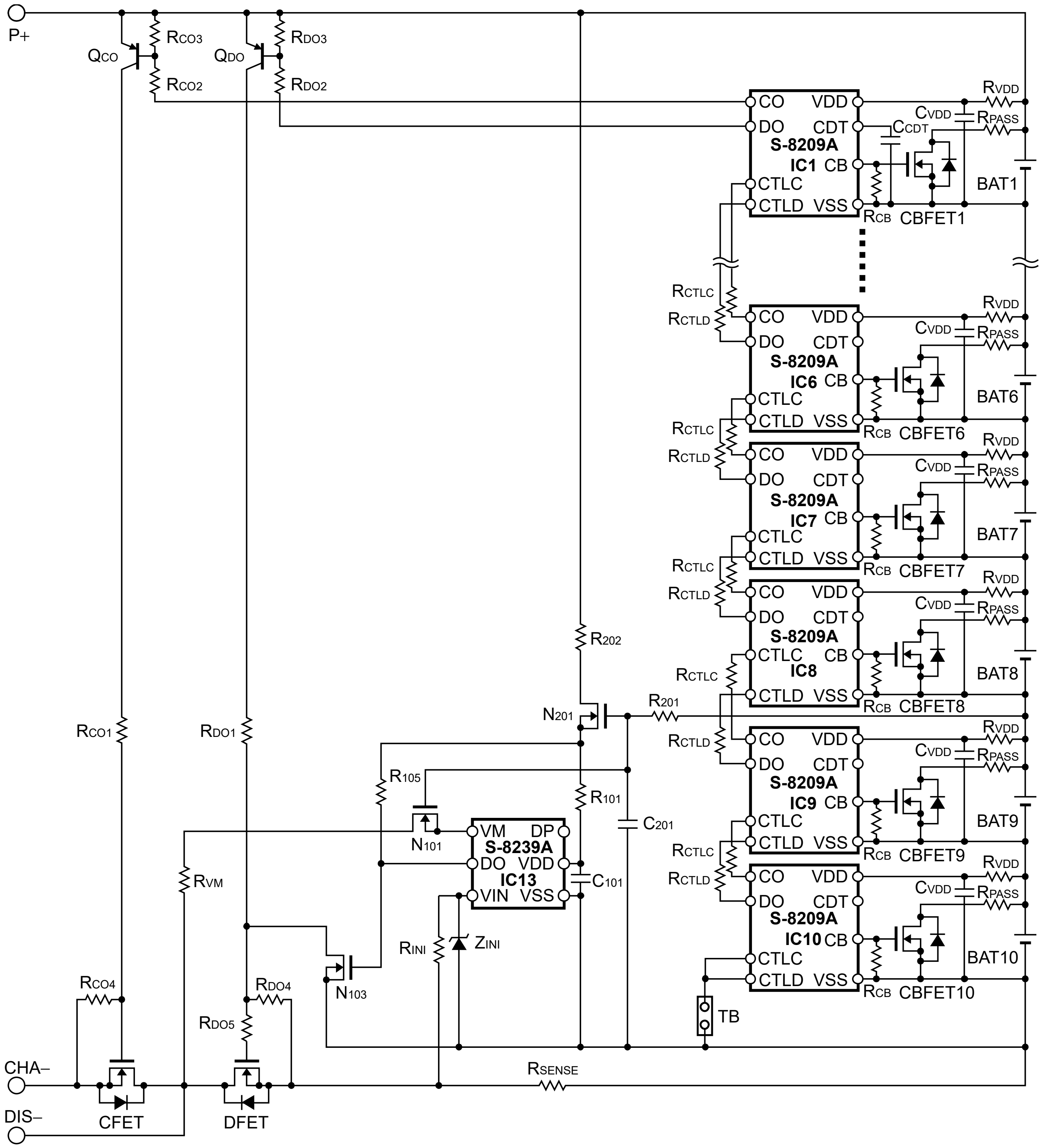
3. 4 10-serial cell protection circuit added the discharge overcurrent protection function (Charge pin and discharge pin are separated, S-8239A Series active "L" product)



Remark Refer to "**4. External components list**" for constants of external components.

Figure 12

3. 5 10-serial cell protection circuit added the discharge overcurrent protection function
(Charge pin and discharge pin are separated, S-8239A Series active "H" product)

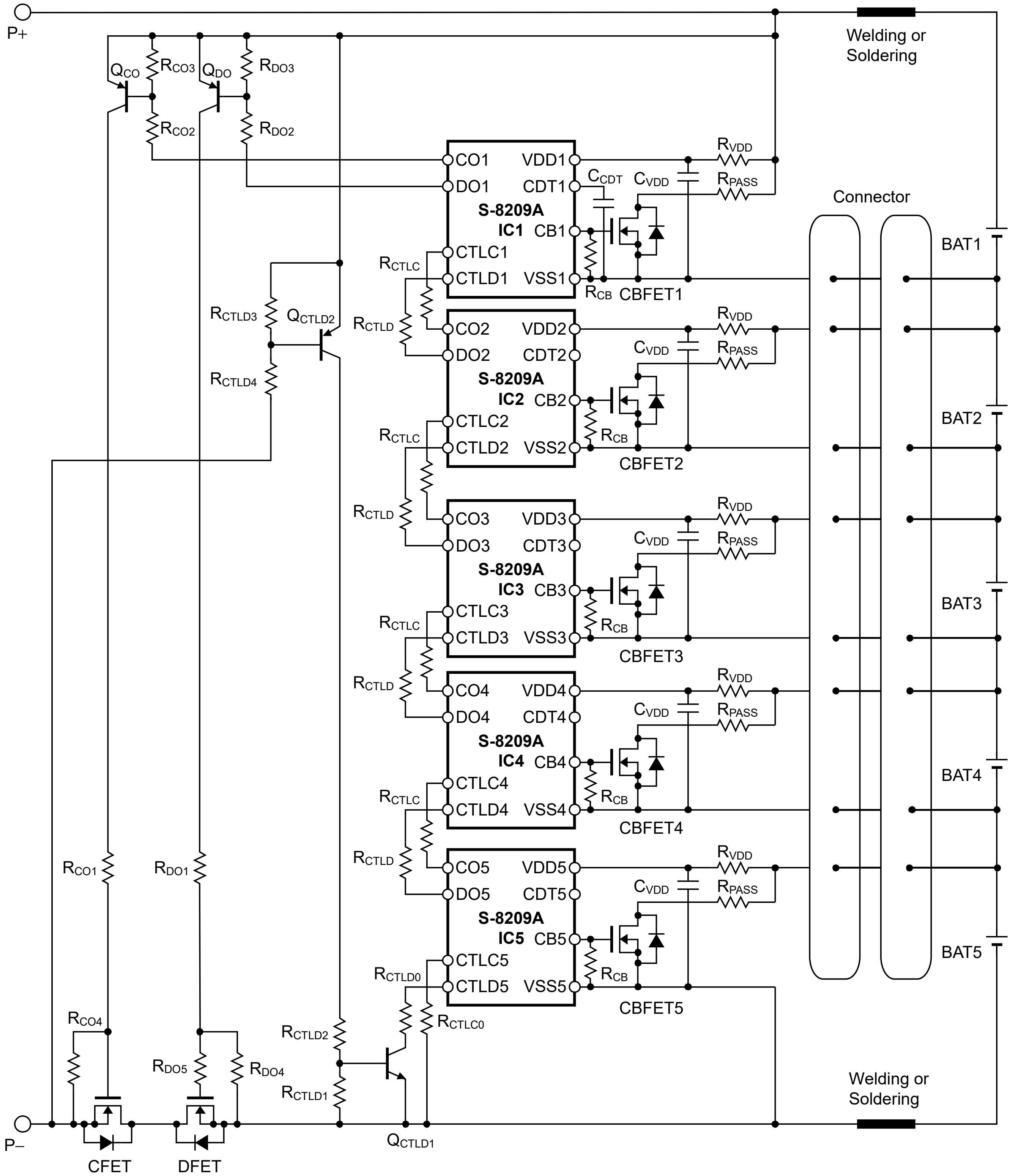


Remark Refer to "**4. External components list**" for constants of external components.

Figure 13

3. 6 5-serial cell protection circuit connected by connectors

In the application that pins are connected by connectors as seen in the application circuit below, safety is enhanced since both charge and discharge stop even if the connectors are disconnected.



Remark Refer to "**4. External components list**" for constants of external components.

Figure 14

4. External components list

Table 4 shows external components in the connection examples in **Figure 1, Figure 6** and **Figure 9** to **Figure 14**.

Table 4 (1 / 2)

Symbol	Typical	Unit	Components name	Maker	Remark
IC1 to IC10	–	–	S-8209A	ABLIC Inc.	Necessary
IC11	–	–	S-8269B*1	ABLIC Inc.	Necessary
IC12	–	–	S-812C30A	ABLIC Inc.	Necessary
IC13	–	–	S-8239A*1	ABLIC Inc.	Necessary
CBFET1 to CBFET10	–	–	–	–	User setting
CFET	–	–	–	–	User setting
DFET	–	–	–	–	User setting
C_{CDT}	–	–	–	–	User setting
C_{IN}	0.1	μF	GRM188	Murata Manufacturing Co., Ltd.	User setting
C_L	0.1	μF	GRM188	Murata Manufacturing Co., Ltd.	User setting
C_{VDD}	0.1	μF	GRM188	Murata Manufacturing Co., Ltd.	Recommended
C_{101}	0.1	μF	–	–	Recommended
C_{201}*2	1	μF	–	–	Recommended
N_{101}	–	–	SSM3K7002KF	Toshiba Electronic Devices & Storage Corporation	Recommended
N_{102}	–	–	SSM3K7002KF	Toshiba Electronic Devices & Storage Corporation	Recommended
N_{103}	–	–	SSM3K7002KF	Toshiba Electronic Devices & Storage Corporation	Recommended
N_{104}	–	–	SSM3K7002KF	Toshiba Electronic Devices & Storage Corporation	Recommended
N_{201}	–	–	SSM3K7002KF	Toshiba Electronic Devices & Storage Corporation	Recommended
P_{101}	–	–	SSM3J168F	Toshiba Electronic Devices & Storage Corporation	Recommended
P_{102}	–	–	SSM3J168F	Toshiba Electronic Devices & Storage Corporation	Recommended
Q_{CO}	PNP	–	2SB1198K	ROHM CO., LTD.	Recommended
Q_{DO}	PNP	–	2SB1198K	ROHM CO., LTD.	Recommended
Q_{CTLD1}	NPN	–	2SC2412K	ROHM CO., LTD.	Recommended
Q_{CTLD2}	PNP	–	2SB1198K	ROHM CO., LTD.	Recommended
R_{CB}	10	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CO1}*3	–	–	–	–	User setting
R_{CO2}	510	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CO3}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CO4}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLC}*4	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLD}*4	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLC0}	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLD0}	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLD1}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLD2}	4.7	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLD3}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{CTLD4}	4.7	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{DO1}*3	–	–	–	–	User setting
R_{DO2}	510	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{DO3}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{DO4}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{DO5}	–	–	–	–	User setting
R_{EB+}	10	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{INI}	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{PASS}*5	–	–	–	–	User setting
R_{SENSE}*5	–	–	–	–	User setting

Table 4 (2 / 2)

Symbol	Typical	Unit	Components name	Maker	Remark
R_{VDD}	470	Ω	MCR03	ROHM CO., LTD.	Recommended
R_{VM}	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{101}	470	Ω	MCR03	ROHM CO., LTD.	Recommended
R_{102}	5.1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{103}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{104}	510	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{105}	1	MΩ	MCR03	ROHM CO., LTD.	Recommended
R_{201}*2	1	kΩ	MCR03	ROHM CO., LTD.	Recommended
R_{202}	100	Ω	MCR03	ROHM CO., LTD.	Recommended
TB*6	–	–	–	–	User setting
Z_{INI}	–	–	UFZV3.6B	ROHM CO., LTD.	Recommended
Z_{VM}*7	–	–	1SMB5930B	Diodes Incorporated	User setting

***1.** Select this product according to the overcurrent detection voltage that you will use.
For details, refer to datasheet of each product.

***2.** At the moment when the S-8269B Series (**Figure 9** to **Figure 11**) or S-8239A Series (**Figure 12**, **Figure13**) detects the overcurrent and turns off DFET, a spike voltage generated in BAT8 (**Figure 9** to **Figure 11**) or BAT9 (**Figure 12**, **Figure13**) may result in transient change of the power supply of the S-8269B Series or S-8239A Series through N_{201} and cause the S-8269B Series or S-8239A Series to malfunction for overcurrent detection. This phenomenon can be prevented by setting C_{201} and R_{201}.
The constant of C_{201} and R_{201} is normally 1 μF × 1 kΩ = 1 mF × Ω. However, since the spike voltage generated in BAT8 or BAT9 differs depending on each application, perform thorough evaluation about the power supply transient change and overcurrent protection function of the S-8269B Series or S-8239A Series using the actual application to set C_{201} and R_{201}.

***3.** Set the resistance with attention to VGS rated value of FET.

***4.** In order to prevent from damage when an overvoltage is applied to the IC, select R_{CTLC} and R_{CTLD} from 1 kΩ to 100 kΩ.

***5.** Pay attention to the rated electric powers.

***6.** TB: Thermal Breaker
When a TB is not necessary, connect the same protection resistor as R_{CTLC} or R_{CTLD}.

***7.** When building a protection circuit for 10-serial or more cells, connect Z_{VM} so that the VM pin voltage does not exceed the absolute maximum rating.

Caution 1. The constants may be changed without notice.
2. It has not been confirmed whether the operation is normal or not in circuits other than the connection examples. In addition, the connection examples and the constants do not guarantee proper operation. Perform thorough evaluation using the actual application to set the constants.

5. Precaution

- The usage described in this application note is typical example with our IC.
  Perform evaluation fully before use.

- When designing for mass production using an application circuit described herein, the product deviation and temperature characteristics of the external components should be taken into consideration. ABLIC Inc. shall not bear any responsibility for patent infringements related to products using the circuits described herein.

- ABLIC Inc. claims no responsibility for any disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

6. Related source

Refer to the following datasheet for details of the S-8209A Series.

S-8209A Series　Datasheet

The information described in this application note and the datasheet is subject to change without notice.
Contact our sales representatives for details.
Regarding the newest version, select product category and product name on our website, and download the PDF file.

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