Confidential
Tentative

S-8203A Series

BATTERY PROTECTION IC FOR 3-SERIES CELL PACK

The S-8203A Series includes high-accuracy voltage detection circuits and delay circuits, in single use, makes it possible for users to monitor the status of 3-series cell lithium-ion rechargeable battery.
The S-8203A Series is suitable for protecting lithium-ion rechargeable battery pack from overcharge, overdischarge, and overcurrent.

■ Features

- High-accuracy voltage detection function for each cell
  - Overcharge detection voltage n (n = 1 to 3) — 3.55 V to 4.40 V[*1] (50 mV step) — Accuracy ±25 mV
  - Overcharge release voltage n (n = 1 to 3) — 3.30 V to 4.40 V[*2] — Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 3) — 2.0 V to 3.2 V[*1] (100 mV step) — Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 3) — 2.0 V ~ 3.4 V[*3] — Accuracy ±100 mV
- Discharge overcurrent detection in 2-step
  - Discharge overcurrent detection voltage — 0.05 V to 0.30 V[*4] (50 mV step) — Accuracy ±15 mV
  - Short circuit detection voltage — 0.50 V to 1.0 V[*4] (100 mV step) — Accuracy ±100 mV
- Charge overcurrent detection
  - Charge overcurrent detection voltage — −0.30 V to −0.05 V (50 mV step) — Accuracy ±30 mV
- Settable by external capacitor; Overcharge detection delay time, Overdischarge detection delay time, Discharge overcurrent detection delay time, Charge overcurrent detection delay time
  (Load short circuit detection delay time is internally fixed.)
- Independent charging and discharge control by the control pins
- Power-down function "yes" / "no" is selectable.
- High-withstand voltage — Absolute maximum rating : 28 V
- Wide range of operation voltage — 2 V to 24 V
- Wide range of operation temperature — Ta = −40°C to +85°C
- Low current consumption
  - During operation — 40 μA max. (Ta = +25°C)
  - During power-down — 0.1 μA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free[*5]

***1.** The overcharge detection voltage n (n = 1 to 3) and overdischarge detection voltage (n = 1 to 3) are not selectable if the voltage difference between them is 0.6 V or less.
***2.** Overcharge hysteresis voltage n (n = 1 to 3) is selectable in 0 V, or in 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detection voltage − Overcharge release voltage)
***3.** Overdischarge hysteresis voltage n (n = 1 to 3) is selectable in 0 V, or in 0.2 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage − Overdischarge detection voltage)
***4.** The discharge overcurrent detection voltage and load short circuit detection voltage are not selectable if the voltage difference between them is 0.3 V or less.
***5.** Refer to "■ **Product Name Structure**" for details.

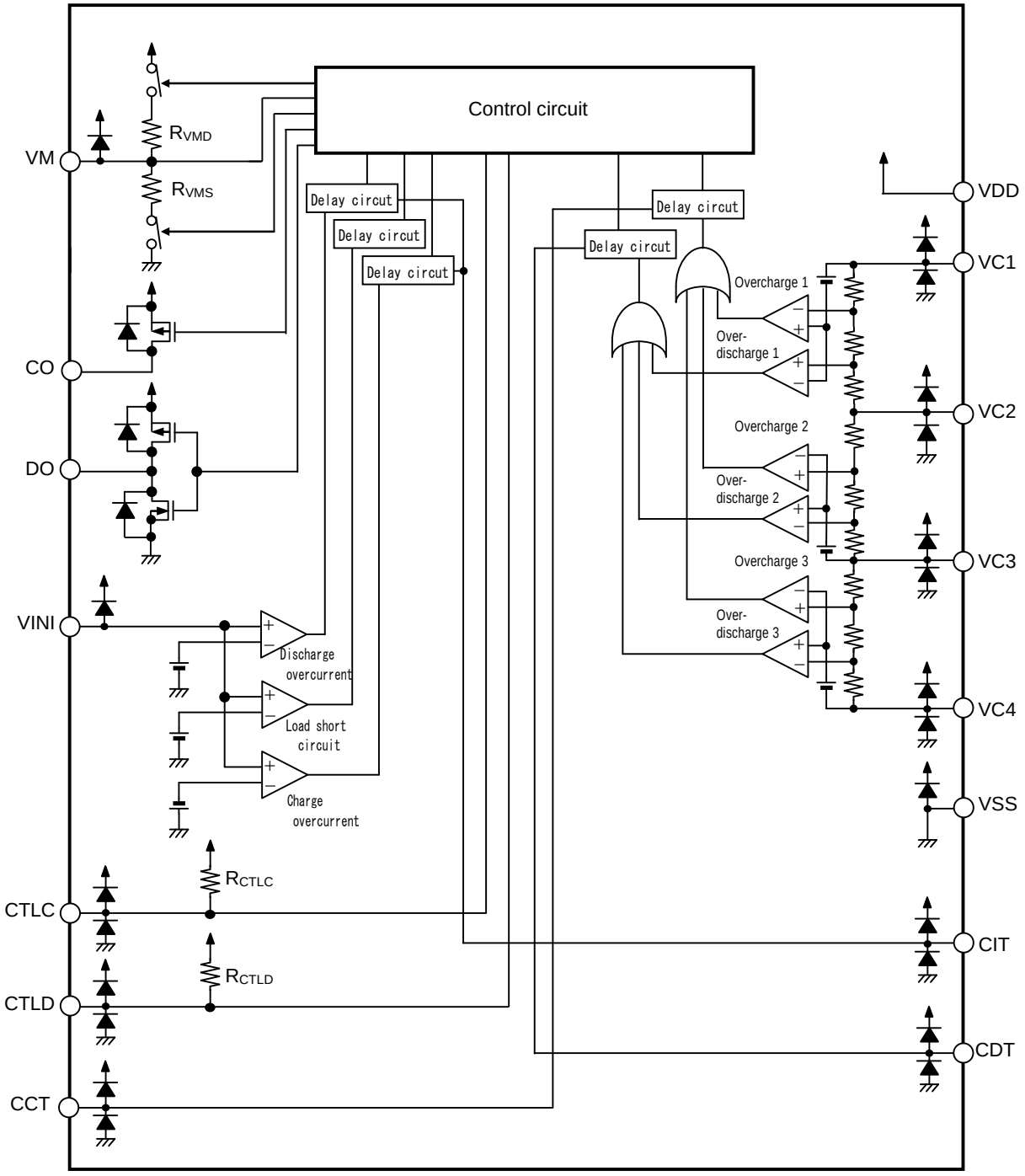
■ Application

- Rechargeable lithium-ion battery pack

■ Package

- 16-Pin TSSOP

■ Block Diagram



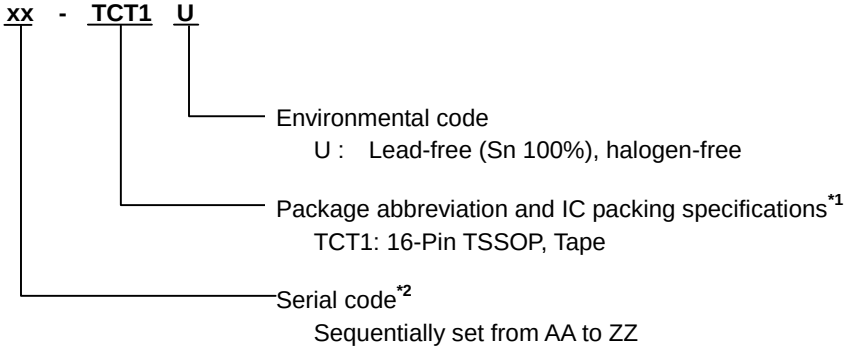
Remark Diodes in the figure are parasitic diodes.

Figure 1

■ Product Name Structure

1. Product Name

S-8203A xx - TCT1 U



***1.** Refer to the tape drawing.

***2.** Refer to "**3. Product Name List**".

2. Package

Table 1 Package Drawing Code

Package Name	Dimension	Tape	Reel
16-Pin TSSOP	FT016-A-P-SD	FT016-A-C-SD	FT016-A-R-S1

3. Product Name List

Table 2 S-8203A Series

Product Name	Overcharge Detection Voltage [V_{CU}]	Overcharge Release Voltage [V_{CL}]	Overdischarge Detection Voltage [V_{DL}]	Overdischarge Release Voltage [V_{DU}]	Discharge Overcurrent Detection Voltage [V_{DIOV}]	Load Short Circuit Detection Voltage [V_{SHORT}]	Charge Overcurrent Detection Voltage [V_{CIOV}]	0 V Battery Charge Function	Power-down Function	Delay Time*1
S-8203AAA-TCT1U	4.250 V	4.150 V	2.70 V	3.00 V	0.20 V	0.50 V	-0.10 V	Available	Yes	(2)
S-8203AAB-TCT1U	4.250 V	4.150 V	2.50 V	3.00 V	0.10 V	0.50 V	-0.05 V	Available	Yes	(2)
S-8203AAC-TCT1U	4.250 V	4.150 V	2.50 V	3.00 V	0.10 V	0.50 V	-0.05 V	Available	No	(2)
S-8203AAD-TCT1U	4.250 V	4.100 V	3.00 V	3.20 V	0.15 V	0.50 V	-0.10 V	Available	Yes	(2)
S-8203AAE-TCT1U	4.350 V	4.150 V	2.40 V	3.00 V	0.15 V	0.50 V	-0.10 V	Available	Yes	(2)
S-8203AAF-TCT1U	4.350 V	4.150 V	2.80 V	3.00 V	0.20 V	0.50 V	-0.10 V	Available	Yes	(2)
S-8203AAG-TCT1U	4.425 V	4.225 V	2.50 V	2.90 V	0.15 V	0.50 V	-0.10 V	Available	Yes	(2)
S-8203AAH-TCT1U	3.650 V	3.500 V	2.20 V	2.30 V	0.10 V	0.50 V	-0.05 V	Available	Yes	(2)
S-8203AAI-TCT1U	3.750 V	3.600 V	2.00 V	2.50 V	0.15 V	0.50 V	-0.10 V	Available	Yes	(2)

***1.** The delay time is set by the external capacitor.
But the discharge overcurrent release delay time (t_{DIOVR}) and charge overcurrent release delay time (t_{CIOVR}) are calculated by discharge overcurrent detection delay time (t_{DIOV}) and charge overcurrent detection delay time (t_{CIOV}) as the following equations. 1 [ms] (typ.) is the internal delay time of the S-8205A Series.

(1) $t_{DIOVR} = t_{DIOV} \times 10 + 1$ [ms] (typ.), $t_{CIOVR} = t_{CIOV} \times 10 + 1$ [ms] (typ.)
(2) $t_{DIOVR} = t_{DIOV} \times 0.05 + 1$ [ms] (typ.), $t_{CIOVR} = t_{CIOV} \times 0.05 + 1$ [ms] (typ.)

Moreover, refer to "**8. Delay Time Setting**" in "■ **Operation**" for calculational methods of delay times.

Remark Please contact our sales office for products with detection voltage values other than those specified above.

■ Pin Configuration

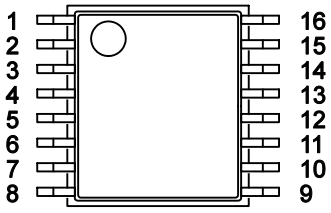


Figure 2

Table 4

Pin No.	Symbol	Description
1	VM	Pin for voltage detection between VSS pin and VM pin
2	CO	FET gate connection pin for charge control (Pch open-drain output) Pin for voltage detection between VSS pin and CO pin
3	DO	FET gate connection pin for discharge control FET (CMOS output)
4	VINI	Pin for voltage detection between VSS pin and VINI pin
5	CTLC	Control pin for charge FET
6	CTLD	Control pin for discharge FET
7	CCT	Capacitor connection pin for delay for overcharge detection voltage
8	CDT	Capacitor connection pin for delay for overdischarge detection voltage
9	CIT	Capacitor connection pin for delay for discharge overcurrent detection, charge overcurrent detection
10*1	VSS	Input pin for negative power supply
11*1	VSS	Input pin for negative power supply
12	VC4	Input pin for negative power supply, Connection pin for battery 3's negative voltage
13	VC3	Connection pin for battery 2's negative voltage, Connection pin for battery 3's positive voltage
14	VC2	Connection pin for battery 1's negative voltage, Connection pin for battery 2's positive voltage
15	VC1	Connection pin for battery 1's positive voltage
16	VDD	Input pin for positive power supply, Connection pin for battery 1's positive voltage

*1 Short VSS pins Pin 10 and Pin 11, and connect them to the same VSS.

■ Absolute Maximum Ratings

Table 5

(Ta = +25°C unless otherwise specified)

Item	Symbol	Applied Pin	Absolute Maximum Rating	Unit
Input voltage between VDD pin and VSS pin	V_{DS}	VDD	V_{SS} − 0.3 to V_{SS} + 28	V
Input pin voltage 1	V_{IN1}	VC1, VC2, VC3, VC4, CTLC,CTLD,CCT,CDT,CIT	V_{SS} − 0.3 to V_{DD} + 0.3	V
Input pin voltage 2	V_{IN2}	VM, VINI	V_{DD} − 28 to V_{DD} + 0.3	V
DO pin output voltage	V_{DO}	DO	V_{SS} − 0.3 to V_{DD} + 0.3	V
CO pin input and output voltage	V_{CO}	CO	V_{DD} − 28 to V_{DD} + 0.3	V
Power dissipation	P_D	–	1100[*1]	mW
Operation ambient temperature	T_{opr}	–	−40 to +85	°C
Storage temperature	T_{stg}	–	−40 to +125	°C

***1.** When mounted on board
[Mounted board]
(1) Board size: 114.3 mm × 76.2 mm × t1.6 mm
(2) Board name: JEDEC STANDARD51-7

Caution The absolute maximum ratings are rated values exceeding which the product could suffer physical damage.These values must therefore not be exceeded under any conditions.

■ Electrical Characteristics

Table 6 (1 / 2)

(Ta = +25°C unless otherwise specified)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Detection Voltage							
Overcharge detection voltage n (n = 1, 2, 3)	V_{CUn}	V1 = V2 = V3 = V_{CU} − 0.05 V	V_{CU} − 0.025	V_{CU}	V_{CU} + 0.025	V	2
Overcharge release voltage n (n = 1, 2, 3)	V_{CLn}	−	V_{CL} − 0.05	V_{CL}	V_{CL} + 0.05	V	2
Overdischarge detection voltage n (n = 1, 2, 3)	V_{DLn}	−	V_{DL} − 0.08	V_{DL}	V_{DL} + 0.08	V	2
Overdischarge release voltage n (n = 1, 2, 3)	V_{DUn}	−	V_{DU} − 0.10	V_{DU}	V_{DU} + 0.10	V	2
Discharge overcurrent detection voltage	V_{DIOV}	−	V_{DIOV} − 0.015	V_{DIOV}	V_{DIOV} + 0.015	V	2
Load short circuit detection voltage	V_{SHORT}	−	V_{SHORT} − 0.10	V_{SHORT}	V_{SHORT} + 0.10	V	2
Charge overcurrent detection voltage	V_{CIOV}	−	V_{CIOV} − 0.03	V_{CIOV}	V_{CIOV} + 0.03	V	2
Temperature coefficient 1[*1]	T_{COE1}	Ta = 0°C to 50°C[*3]	−1.0	0	1.0	mV/°C	−
Temperature coefficient 2[*2]	T_{COE2}	Ta = 0°C to 50°C[*3]	−0.5	0	0.5	mV/°C	−
Delay Time Function[*4]							
CCT pin internal resistance	R_{CCT}	V1 = 4.5 V, V2 = V3 = 3.5 V	6.15	8.31	10.2	MΩ	3
CDT pin internal resistance	R_{CDT}	V1 = 1.5 V, V2 = V3 = 3.5 V	615	831	1020	kΩ	3
CIT pin internal resistance	R_{CIT}	−	123	166	204	kΩ	3
CCT pin detection voltage	V_{CCT}	V1 = 4.5 V, V2 = V3 = 3.5 V	V_{DS} × 0.68	V_{DS} × 0.70	V_{DS} × 0.72	V	3
CDT pin detection voltage	V_{CDT}	V1 = 1.5 V, V2 = V3 = 3.5 V	V_{DS} × 0.68	V_{DS} × 0.70	V_{DS} × 0.72	V	3
CIT pin detection voltage	V_{CIT}	V6 = V_{DIOV} + 0.015 V	V_{DS} × 0.68	V_{DS} × 0.70	V_{DS} × 0.72	V	3
Load short circuit detection delay time	t_{SHORT}	−	100	300	600	μs	2
CTLC pin response time	t_{CTLC}	−	−	−	2.5	ms	2
CTLD pin response time	t_{CTLD}	−	−	−	2.5	ms	2
0 V Battery Charge Function							
0 V battery charge starting charger Voltage	V_{0CHA}	0V battery charge function "available" V1 = V2 = V3 = 0 V	−	0.8	1.5	V	4
0 V battery charge inhibition battery voltage	V_{0INH}	0 V battery charge function "unavailable"	0.4	0.7	1.1	V	2
Internal Resistance							
CTLC pin internal resistance	R_{CTLC}	−	7	10	13	MΩ	5
CTLD pin internal resistance	R_{CTLD}	−	7	10	13	MΩ	5
Resistance between VM pin and VDD pin[*5]	R_{VMD}	V1 = V2 = V3 = 1.8 V	450	900	1800	kΩ	5
Resistance between VM pin and VSS pin	R_{VMS}	−	250	500	750	kΩ	5

Table 6 (2 / 2)

(Ta = +25°C unless otherwise specified)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Input Voltage							
Operation voltage between VDD pin and VSS pin*6	V_{DSOP}	Fixed output voltage of DO pin and CO pin	2	–	24	V	–
CTLC pin change voltage*6	V_{CTLC}	–	2.1	3.0	4.0	V	2
CTLD pin change voltage*6	V_{CTLD}	–	2.1	3.0	4.0	V	2
Input Current							
Current consumption during operation	I_{OPE}	–	–	20	40	µA	1
Current consumption during power-down*5	I_{PDN}	V1 = V2 = V3 = 1.5 V	–	–	0.1	µA	1
VC1 pin current	I_{VC1}	–	0	0.8	2.0	µA	5
VC2 pin current	I_{VC2}	–	–0.3	0	0.3	µA	5
VC3 pin current	I_{VC3}	–	–0.3	0	0.3	µA	5
VC4 pin current	I_{VC4}	–	–2.0	-0.8	0	µA	5
Output Current							
CO pin source current	I_{COH}	V13 = 0.5 V	10	–	–	µA	5
CO pin leakage current	I_{COL}	V1 = V2 = V3 = 8.0 V	–	–	0.1	µA	5
DO pin source current	I_{DOH}	V14 = 0.5 V	10	–	–	µA	5
DO pin sink current	I_{DOL}	V15 = 0.5 V	–	–	–10	µA	5

***1.** Voltage temperature coefficient 1: Overcharge detection voltage。

***2.** Voltage temperature coefficient 2: Discharge overcurrent detection voltage

***3.** Since products are not screened at high and low temperature, the specification for this temperature range is guaranteed by design, not tested in production.

***4.** Refer to "■ **Operation**" for details of delay time function.

***5.** For products with power-down function

***6.** The S-8203A Series does not operate detection if the operation voltage between VDD pin and VSS pin (V_{DSOP}) is CTLC pin change voltage (V_{CTLC}) or CTLD pin change voltage (V_{CTLD}) or less.

■ Connection Examples of Battery Protection IC

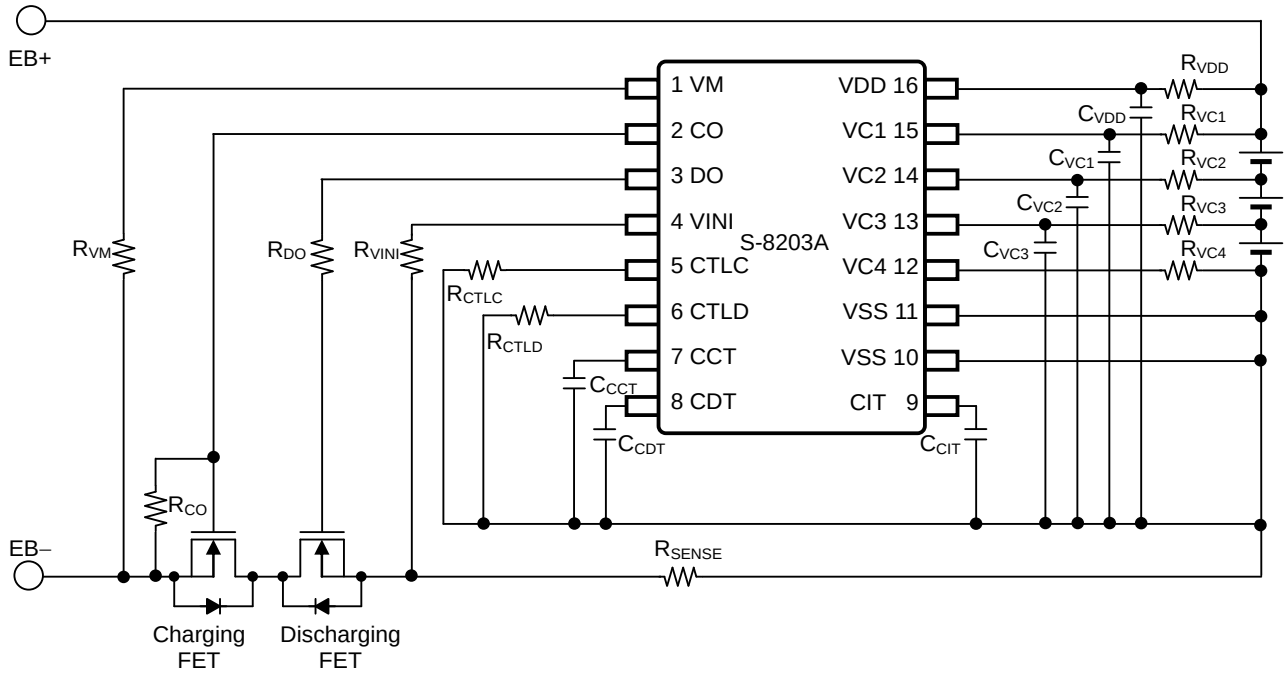


Figure 3

Table 7 Constants for External Components

Symbol	Min.	Typ.	Max.	Unit
R_{VC1} *1	0.47	1	1	kΩ
R_{VC2} *1	0.47	1	1	kΩ
R_{VC3} *1	0.47	1	1	kΩ
R_{VC4}	0.47	1	1	kΩ
R_{DO}	1	5.1	10	kΩ
R_{CO}	0.1	1	1	MΩ
R_{VM}	3	5.1	10	kΩ
R_{CTLC}	0.1	1	1	kΩ
R_{CTLD}	0.1	1	1	kΩ
R_{VINI}	0.1	1	1	kΩ
R_{SENSE}	0	–	–	mΩ
R_{VDD} *1	43	100	100	Ω
C_{VC1} *1	0.068	0.1	1	µF
C_{VC2} *1	0.068	0.1	1	µF
C_{VC3} *1	0.068	0.1	1	µF
C_{CCT}	0.01	0.1	–	µF
C_{CDT}	0.01	0.1	–	µF
C_{CIT}	0.02	0.1	–	µF
C_{VDD} *1	0	1	10	µF

***1.** Set up a filter constant to be $R_{VDD} \times C_{VDD} = 68\ \mu F \cdot \Omega$ or more, and to be $R_{VC1} \times C_{VC1} = R_{VC2} \times C_{VC2} = R_{VC3} \times C_{VC3} = R_{VDD} \times C_{VDD}$.

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

■ Precautions

- The application conditions for the input voltage, output voltage, and load current should not exceed the package power dissipation.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- SII claims no responsibility for any and all disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.